PB85-213957

Superfund Record of Decision (EPA Region 5) Outboard Marine Corporation Site Waukegan, Illinois, May 1984

(U.S.) Environmental Protection Agency
Washington, DC

15 May 84

U.S. Department of Commerce
National Technical Information Service
NTIS

United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

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May 1984

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EPA

Superfund Record of Decision:

Outboard Marine Corp. Site, IL

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TECHNICAL REPORT DATA
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15. SUPPLEMENTARY NOTES	

16. ABSTRACT

The Outboard Marine Corporation (OMC) site is located north of Chicago on the shore of Lake Michigan. It is the location of an outboard motor manufacturing plant which used polychlorinated biphenyls (PCBs) in its die cast machines for about 20 years ending in the early 1970's. Discharges from the facility resulted in highly contaminated sediment in Waukgan Harbor and contaminated soil in the parking lot north of the plant and the "North Ditch," a tributary of Lake Michigan.

The cost-effective option considered for this site was excavation and off-site disposal of PCB-contaminated material. This is the only option that meets the requirements of TSCA and guarantees the halt of PCB migration.• The cost of this option is more than $75 million. Because of the high cost to implement this option it was necessary to Fund Balance. Fund Balancing is appropriate where the alternative that would fully satisfy the technical requirements of other environmental laws is extremely expensive, and another alternative which approaches the same level of effectiveness can be implemented for a much lower cost. The Fund Balanced alternative for this site provides for off-site disposal of PCB contaminated hot-spots and on-site containment of the moderately contaminated materials. The cost of the Fund Balanced selected alternative is estimated to be $21.57 million.

Key Words: On-Site Containment, PCBs, NEPA, Dredging, Water Quality Standards, Fund Balancing

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision Outboard Marine Corp. Site, IL Contaminated media: gw, sw, soil, river sediments, fish, air Key contaminants: PCBs, hydraulic fluids, oils		

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Record of Decision
Remedial Alternative Selection

SITE: Outboard Marine Corporation (OMC), Waukegan, Illinois

DOCUMENTS REVIEWED:

I have reviewed the following documents describing the analysis of cost-effectiveness of remedial alternatives for the OMC Site:

- OMC Feasibility Study, CH2M-Hill, July 14, 1983
- OMC Technical Documentation (a staff summary of the information collected during sampling, modeling and engineering studies conducted by Region V as part of the litigation effort)
- Summary of the Remedial Action Alternative Selection
- Responsiveness summary addressing comments received from the public.

DESCRIPTION OF THE SELECTED ALTERNATIVE:

- The alternative selected for each segment of the site is shown on the attached Table 1.

DECLARATIONS:

Consistent with CERCLA and the NCP, I have determined that the source control remedy described in Table 1 is the appropriate Fund-financed action for this site in accordance with section 300.68(j) and (k) of the NCP. Although the selected remedy does not meet all the requirements of regulations issued under TSCA and is somewhat less protective than the cost-effective option as defined by the NCP, the remedy is expected to be reasonably effective in preventing the migration of PCB from the site which would threaten public health, welfare or the environment. In addition, this remedy is expected to be significantly less expensive than any alternative which would be fully consistent with TSCA regulations and protective of public health. Therefore, I have determined that the level of protection provided by the selected remedy is appropriate considering the need for additional protection at this site and the amount of money available in the Fund to respond to other sites which present or may present a threat to public health, welfare or the environment.

11

The State of Illinois has been consulted and agrees with the remedy. The action will require future operation and maintenance activities to ensure the continued effectiveness of the remedy. These activities will be considered part of the approved action and eligible for Trust Fund monies for a period of one year. In accordance with section 104(c)(3), the State is required to ensure the continued operation and maintenance of the selected remedy.

In addition, the offsite transport and secure disposition of the highly contaminated material (see Table 1) is more cost effective than other remedial action and is necessary to protect public health, welfare or the environment.

Lee M. Thomas
Assistant Administrator
Office of Solid Waste and Emergency Response

May 15, 1984

Date

COMPONENTS OF THE FUND BALANCED ALTERNATIVE

Site Segment	Remedy Recommended	Cost
A. Waukegan Harbor		
1. Highly contaminated material (hot spots - >10,0000 ppm)	Excavation, dewatering, fixation and off-site disposal in a PCB landfill.	$ 3.15 Million
2. Moderately contaminated material (500 - 10,000 ppm)	Excavation, dewatering in lagoon, fixation to minimize volatilization, and disposal on OMC parking lot.	$10.00 Million
3. Less contaminated material (50 - 500 ppm)	Excavation, long term dewatering in lagoon, and disposal on OMC parking lot.	
B. Oval Lagoon/Crescent Ditch		
1. Highly contaminated material (>10,000 ppm)	Excavation and off-site disposal in a PCB landfill.	$ .74 Million
2. Less contaminated material	Containment on site. - Slurry walls down to glacial till - Impermeable cap	
C. North Ditch		$ 4.21 Million
1. Material above storm sewer	Excavate and contain in the Oval Lagoon.	
2. Material below storm sewer	Capped with clean fill and clay cap.	
D. Parking Lot	Contained in place with contaminated dredge spoils from Waukegan Harbor. - Slurry walls down to glacial till - Impermeable cap	$ 3.2 Million
TOTAL		$21.30 Million

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

REPLY TO ATTENTION OF:

MEMORANDUM

MAY 4 1984

SUBJECT: Recommendation for Remedial Implementation Alternative Selection - OMC Hazardous Waste Site, Waukegan, Illinois

FROM: Valdas V. Adamkus
Regional Administrator

TO: Lee M. Thomas
Assistant Administrator
Office of Solid Waste and
Emergency Response

EPA has completed the following remedial CERCLA activities at the Outboard Marine Corporation (OMC) Site located in Waukegan, Illinois.

Activity	Date
Final Work Plan, Source Control Feasibility Study	3/28/83
Source Control Feasibility Study Report	7/15/83
Opening of First Public Comment Period	7/15/83
Public Informational Meeting	7/28/83
Public Meeting	8/3/83
Close of First Public Comment Period	9/1/83
Opening of Second Public Comment Period	3/6/84
Public Informational Meeting	3/14/84
Close of Second Public Comment Period	4/4/84

Region V has reviewed the information in the reports and has given careful consideration to the comments received in the public comment periods. Pursuant to Section 104(c)(2) of CERCLA, we have consulted with the State of Illinois before determining the appropriate remedial action. Based on our review, Region V recommends that the following actions at the

OMC Site effectively mitigate and minimize damage to and provide acceptable protection of public health, welfare, and the environment. The recommended action included some off-site transport as such action is more cost-effective than other remedial actions and is necessary to protect public health, welfare, and the environment from the potential risk which may be created by further exposure to the continued presence of PCBs at the OMC Site. As discussed with your staff, the following recommendation includes fund balanced considerations.

Action	Estimated Cost
Dredge, Dewater, Dispose, Cap in Parking Lot (Slip No.3 and the Upper Harbor)	$ 9,940,000
Dredge, Remove, Fix and Dispose 5,700 yd^3 of PCB-contaminated material	$ 3,150,000
Excavate North Ditch, Contain in Crescent Ditch/Oval Lagoon and Cap	$ 4,210,000
Excavate and Dispose 5,500 yd^3 of PCB-contaminated material (Crescent Ditch/Oval Lagoon)	$ 740,000
Contain and Cap (Parking Lot)	$ 3,210,000
TOTAL	$21,250,000

Operation and maintenance costs for the site are estimated to be $84,250 annually, or $800,000 for 30 years on a present worth basis of 10%. The Illinois Environmental Protection Agency will be responsible for the operation and maintenance.

Region V additionally recommends that EPA share in the costs of operation and maintenance for a period of one year following completion of the project. This time frame is needed to allow for settling of the cells and to assure the integrity of the cells.

Alan Levin (Acting)

Valdas V. Adamkus

VI

Illinois Environmental Protection Agency · 2200 Churchill Road, Springfield, IL 62706

217/782-5544

Mr. Basil Constantelos
Director, Waste Management Division
United States Environmental Protection Agency,
Region V
230 South Dearborn Street
Chicago, IL 60604

Re: Source Control Feasibility Study
OMC - Waukegan Harbor Site

Dear Mr. Constantelos:

On September 19, 1983, the Agency transmitted to your office a letter endorsing the alternatives set forth in Section 7 of the Source Control Feasibility Study for the OMC - Waukegan Harbor site dated July 14, 1983, as being an approach which is technologically feasible in providing adequate protection of public health, welfare and the environment. The Agency also concluded that the approach was cost-effective as long as the control alternatives were implemented in a phased manner to allow the flexibility to assess development of new technologies at the various increments of the project.

On May 1, 1984, members of Region V staff presented to myself, Agency staff members, and a representative of the Illinois Attorney General's Office a proposal which would replace Alternative 6B as set forth in the July 14, 1983, feasibility study with Alternative 6D as set forth in a letter, dated April 4, 1984, which was prepared in response to a request from USEPA - Region V by the authors of the feasibility study. The Agency does not object to substitution of alternative 6D as long as alternative 6D and the remaining Section 7 alternatives are implemented in a phased manner which recognizes the fiscal constraints on the State of Illinois in raising its matching share, and which allows the flexibility to assess the development of new technologies at the various increments of the project.

Sincerely,

Richard J. Carlson
Director

cc: Jim Frank
Roger Kanerva
Gary King

RJC:GPK:kam

Summary of Remedial Alternative Selection - OMC Hazardous Waste Site, Waukegan, Illinois

I. Site Location and Description

The Outboard Marine Corporation site (OMC) is located near the intersection of Grand Avenue and Sheridan Road on the west shore of Lake Michigan in Waukegan, Illinois, about 37 miles north of Chicago and 10 miles south of the Wisconsin state border. See diagram on next page.

Waukegan Harbor is an irregularly shaped harbor about 37 acres in area. The two areas of concern are Slip No. 3 and the Upper Harbor. PCB concentrations in Slip No. 3 are greater than 500 parts per million (ppm). In the Upper Harbor, PCB concentrations are between 50 and 500 ppm. Water depths in the harbor generally vary from 14 to 25 feet with some shallower depths in Slip No. 3. The harbor sediments consist of 1 to 7 feet of very soft organic silt (muck) overlying typically 4 feet of medium dense, fine to coarse sand. A very stiff silt (glacial till) that typically ranges from 50 to more than 100 feet thick underlies the sand. The entire harbor is bordered by 20- to 25-ft-long steel sheet piling, except at the Waukegan Port District boat launching areas and at the retaining wall near the harbor mouth. The sheet piles generally extend into the sand layer above the glacial till.

The North Ditch is a small tributary of Lake Michigan that drains surface runoff from about 0.11 square miles of OMC and North Shore Sanitary District property. The ditch also drains surface runoff from an area west of OMC property and the railroad tracks. The North Ditch includes the 600-ft-long, 20-ft-wide Crescent Ditch; the 240-ft-long, 10- to 20-ft-40-ft-wide Oval Lagoon; and a 2,000-ft-long, 10-to 20-ft-wide east-west portion of the North Ditch. PCB concentrations are between 50 and 5,000 ppm in the North Ditch/Crescent Ditch/Oval Lagoon area. The U.S. Department of the Interior measured the mean daily discharge of the ditch between March and September 1979 as 1.8 cubic feet per second (cfs), with a maximum discharge of 5.3 cfs. They calculated the 5-year storm event to be 23 cfs.

The Parking Lot area is located north of OMC's Plant No. 2 and is about 9 acres in area. PCB concentrations are between 50 to 5,000 ppm. There are three entrances to the Parking Lot area: two fenced entrances in the northwest corner of OMC's property and one fenced entrance southeast of OMC's new die-cast complex at the intersection of OMC's private road and Seahorse Drive.

The generalized subsurface conditions in the North Ditch/Parking Lot area consist of typically 30 feet of compact, very fine to fine sand overlying a stiff too very stiff silt (glacial till). The thickness of the glacial till typically ranges from 50 to more than 100 feet.

The presence of high levels of PCBs in soil and harbor sediments in the vicinity of the OMC plant was discovered in 1976. In Slip No. 3, approximately 10,900 yd^3 of material are contaminated by PCBs (exceeding 50 ppm). Available data indicates that approximately 305,200 lb of PCBs exist in the contaminated slip. Currently no barriers exist to retard migration of the materials into the Upper Harbor and potentially Lake Michigan. This is exaserbated by continual boat traffic in the harbor. Approximately 35,700 yd^3 of muck in the Upper Harbor are contaminated by about 5,000 lb of PCBs (exceeding 50 ppm). See Exhibit C pg 1-6. In the North Ditch/Parking Lot area, approximately 175,800 yd^3 of material are contaminated by PCBs (exceeding 50 ppm). Currently available information indicates that approximately 771,200 lbs of PCBs exist in this contaminated area. See Exhibit C pg 1-6. Currently no barriers exist to retard migration of the substances into the environment.

It is currently estimated that 7 to 20 lb of PCBs are discharged annually into Lake Michigan from the North Ditch. The groundwater is within 3 feet of the surface of the Parking Lot area, resulting in contamination of this water. It is estimated that the slowly moving water will begin releasing some 8 lb/day of PCBs into Lake Michigan in approximately 60 years. Existing air contamination from the North Ditch waters is estimated at 15 lb/yr. Any additional movement of the soil, currently under the paved parking lot, could cause additional volitalization of PCBs. See Exhibit C pg 6-16. Approximately 98.4 percent of the PCBs now found in the Slip/Harbor area are located in Slip No. 3, 1.6 percent have migrated into the Upper Harbor. See Exhibit C, pg 8-9.

Site History

Discharges of process water cooling water, and water from floor drains, from OMC are the major source of PCB contamination to the area. About 9 million pounds of PCB's were purchased from the Monsanto Company from the early 1950's to 1971. These PCB's were used as hydraulic fluids in die casting machines and related equipment.

Because the hydraulic systems in which the hydraulic fluids were used leaked routinely, the fluids containing PCB's escaped from die-cast machinery onto the surrounding floor area. OMC has advised U.S. EPA that 10 to 15 percent of all PCB's purchased may have escaped through floor drains and an oil interceptor system. The floor drains discharge to Waukegan Harbor and the North Ditch Drainage. U.S. EPA has estimated that the discharge could have been as high as 20%.

Release of PCB's from the site is from Surface Water, Volatilization, Groundwater, and the Food Chain. Possible receptors include the biological community of the harbor, North Ditch, and Nearshore Lake Michigan Area. People are exposed or potentially exposed through fish consumption, potentially through the drinking water supply, and by direct contact.

The official 1980 Census figure for the City of Waukegan is 67,653. The Harbor area, however, is zoned for industrial use. Fifteen businesses are located in the immediate Harbor area and provide jobs to approximately 3,500. The local Port Harbor for primarily recreational use. Long term plans additionally include a development of the Upper Harbor. See Exhibit C pgs 6-12, 6-13.

The population is exposed to PCB through three medias; air, water, and the food chain (primarily fish). It is currently estimated that 22 lb of PCBs are released into Lake Michigan each year from Waukegan Harbor water (based on a steady state model). Approximately 12 to 40 lb of PCBs are released from the Harbor into the local airshed each year. Existing air contamination from the North Ditch waters is estimated at 15 lb/yr. See Exhibit C pgs 6-16 through 6-17. Total PCB concentrations vary from 0.6 parts per billion (ppb) in Waukegan Harbor to less than 0.01 ppb in Lake Michigan directly offshore from Waukegan Harbor. There is an emergency water supply intake for Waukegan near the mouth of the harbor, although it is rarely utilized. See Exhibit C pg 6-20. In U.S. EPA studies on Lake Michigan fish, results ranged from concentrations of 2.7 ppm to 187 ppm PCB in fatty tissue for all species.

Enforcement

U.S. EPA filed suit against the OMC and Monsanto Companies in 1976. The suit is still in effect, not being brought to trial. The existing suits may be dismissed and reinstated as a Superfund Cost Recovery Action following implementation of the cleanup. U.S. EPA has conducted several years of negotiations with OMC to try and reach an agreement regarding a cleanup plan. Since no agreement could be reached over a long period of time, Region V recommended to Headquarters that the Fund be accessed for the cleanup.

Alternatives Evaluation

The feasibility study began with an evaluation of over 70 unit processes or methods to determine their potential for contributing to PCB removal. The processes retained from preliminary screening were assembled into 21 alternatives. Finally 17 alternatives and two subalternatives were selected for more detailed evaluation. Final alternative selection was based upon the Feasibility Study, input from the community relations program, and input from various headquarter's offices.

Community Relations

Prior to the selection of the appropriate remedial action at the OMC site the following actions were taken and the documents identified were reviewed by the Regional staff:

A. On March 28, 1983, a Final Work Plan, Source Control Feasibility Study, OMC site, Waukegan, Illinois was authorized. U.S. EPA Work Authorization 13-5M28.0.

B. On July 14, 1983, a Source Control Feasibility Study, OMC Hazardous Waste Site, Waukegan, Illinois (FS) was completed.

C. On July 15, 1983, a public comment period to evaluate and comment on the FS began. A public informational meeting was held in Waukegan on July 28, 1983, to respond to any questions by the public. On August 3, 1983, a public meeting was held in Waukegan to receive formal public comment on the FS. Finally, on September 1, 1983, the extended public comment period was closed.

D. Twenty-five written comments in addition to the comments received during the public hearing were received and responded to by the Region.

E. On March 6, 1984, a second public comment period to evaluate and comment on two issues in addition to the FS began. A public informational meeting was held in Waukegan on March 14, 1984, to respond to any questions by the public. On April 4, 1984, the public comment period closed.

F. Over 250 public comments were received during the public comment period and responded to by the Region.

G. As affected Agencies, the Illinois Environmental Protection Agency and the U.S. Corp of Engineers were informed of and involved in the preparation of the FS. Additionally, pursuant to 16 U.S.C. 662(a), the U.S. fish and Wildlife Service, Department of Interior was informed about the FS. No adverse comments were received by U.S. EPA from these Agencies.

Consistency with other Environmental Laws

U.S. EPA conducted the feasibility study process in accordance with the National Contingency Plan, and to the greatest extent possible, in compliance with the National Environmental Policy Act. U.S. EPA developed a cost effective alternative which is consistent with other environmental laws applicable to the site. Since a Fund-Balanced alternative is under review a Superfund waiver from TSCA requirements may be needed.

Recommended Alternative

In accordance with Part 300.68(J) U.S. EPA conducted a complete cost effective analysis concerning a wide range of alternatives. The alternative presented below also contains fund balancing considerations.

Slip No. 3 and Upper Harbor: Hot Spot Removal

PCB-contaminated sediment, sand and silt would be dredged from the localized area near the former OMC outfall (drainage pipe). This material contains the greatest PCB concentrations in the harbor and represents 92 percent of all the PCBs now found in Slip No. 3 and the Upper Harbor. This alternative would remove, fix, and dispose of offsite an estimated 5,700 yd^3 of PCB contaminated material, containing about 286,500 lb of PCBs. The material would be disposed of in an off-site licensed chemical waste landfill. The estimated cost for this alternative is $3,150,000.

Slip #3 and Upper Harbor: Dredge, Dewater, and Dispose in Parking Lot

A sediment dispersal control device would be installed at the southern end of the Upper Harbor. A clay-lined dewatering lagoon will be constructed an the OMC vacant foundary property. Sediments in excess of 50 ppm PCB will be removed from the harbor by hydraulic dredging. Sediment slurry will be pumped to the dewatering lagoon. Supernatant would be decanted, treated to 1 ppb PCB's and returned to the harbor.

Solids would be treated in two fashions

1) Highly contaminated material from slip:

dredge ——> initial dewatering ——> fixation

2) Less contaminated material from the harbor:

dredge ——> initial dewatering ——> mechanical dewatering

Solids will be periodically removed by dragline and hauled by truck for disposal in the parking lot. This will be codisposed with the existing contamination in the parking lot.

Approximately 46,600 yd^3 of sediments containing about 24,700 lbs of PCB's would be removed from the harbor, dewatered, and disposed in the parking lot. Contaminated lagoon material would also be brought to the parking lot. This alternative is estimated to cost $9,940,000.

North Ditch Area: Hot Spot Removal

PCB contaminated soil would be excavated from the localized areas in the Cresent Ditch and Oval Lagoon. This material contains about 89 percent of all the PCB's now found in the North Ditch area, and about 57 percent of all the PCB's now found in the North Ditch parking lot areas. This alternative would remove and dispose of an estimated 5,500 yd^3 of soil containing about 440,500 lb of PCB's. The soil would be disposed of in an offsite licensed chemical waste landfill. The estimated cost is $740,000.

North Ditch Area: Install Bypass Sewer and Contain Onsite Contaminated N.D. Material

PCB-contaminated soil would be contained and capped in the Cresent Ditch/ Oval Lagoon area. The North Ditch would be partly excavated to install a bypass drainage pipeline. The PCB-contaminated soil from the bypass excavation would be placed in the Cresent Ditch/Oval Lagoon area before cappinng the area. This alternative would contain about 492,100 lb of PCB's in 51,400 yd^3 of soil. The estimated cost is $4,210,000.

Parking Lot: Contain and Cap

Approximately 277,700 lbs. of PCB's in 105,000 yd^3 of soil occur in the OMC parkling lot. 46,600 yd^3 of dredge material from the harbor will be brought to the site, graded and compacted.

The total contamination will be contained with slurry walls andd capped in place. The elevation of the parking lot will increase 14 feet. This portion of the project is estimated to cost $3,210,000.

The total estimated cost to implement the above recommended cleanup action is ~~$20,750,000~~.
$21,250,000

Operation and Maintenance

According to our memo concerning predicted O&M requirements of the proposed project, O&M will involve moving of vegatative containment cell covers and sampling monitoring wells. The design life of the structures is 30 years. Annual O&M costs are estimated to be 84,250. This is also estimated to be $800,000 for 30 years on a present worth basis at 10%.

The Illinois Environmental Protection Agency is identified as the State Agency responsible for O&M.

Schedule	Date of Implementation
Key Milestones	(after ROD signature)
Complete Enforcement Negotiations	30 days
Aware/AG for Design Coord.	Completed
Superfund State Contract	45 days
Award IAG to initiate design	40 days
Start Design	45 days
Complete Design	6 months
Award Cooperative Agreement for Construction	8 months
Award Superfund State Contract for Construction	8 months
Start Construction	10 months
Complete Construction	3.5 years

Future Actions

Following construction, U.S. EPA will be responsible for O&M for one year. At that point long term O&M will revert to State responsibility.

OMC - Technical Documentation

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BRIEFING MATERIAL ON OMC REMEDIAL ACTION

I. BACKGROUND

A. Site Description

The Outboard Marine Corporation site (OMC) is located near the intersection of Grand Avenue and Sheridan Road on the west shore of Lake Michigan in Waukegan, Illinois, about 37 miles north of Chicago and 10 miles south of the Wisconsin state border. The site may be divided into three areas: Waukegan Harbor, the North Ditch and the OMC parking lot. See Figure 1.

Waukegan Harbor is an irregularly shaped harbor about 37 acres in area. The two areas of the Harbor of concern to this project are Slip No. 3 and the Upper Harbor. Water depths in the Harbor generally vary from 14 to 25 feet with some shallower depths in Slip No. 3. The Harbor sediments consist of 1 to 7 feet of very soft organic silt (muck) overlying 4 feet of medium dense, fine to coarse sand. A very stiff silt (glacial till) that typically ranges from 50 to more than 100 feet thick underlies the sand. The entire Harbor is bordered by 20- to 25-ft-long steel sheet piling, except at the Waukegan Port District boat launching areas and at the retaining wall near the Harbor mouth. The sheet piles generally extend into the sand layer above the glacial till.

The North Ditch is a small tributary of Lake Michigan that drains surface runoff from about 0.11 square miles of OMC and North Shore Sanitary District property. The ditch also drains surface runoff from an area west of OMC property and the railroad tracks. The North Ditch includes the contain the 600-ft-long, 20-ft-wide Crescent Ditch; the 240-ft-long, 10- to 40-ft-wide Oval Lagoon; and a 2,000-ft-long, 10-to 20-ft-wide east-west portion of the North Ditch. The U.S. Department of the Interior measured the mean daily

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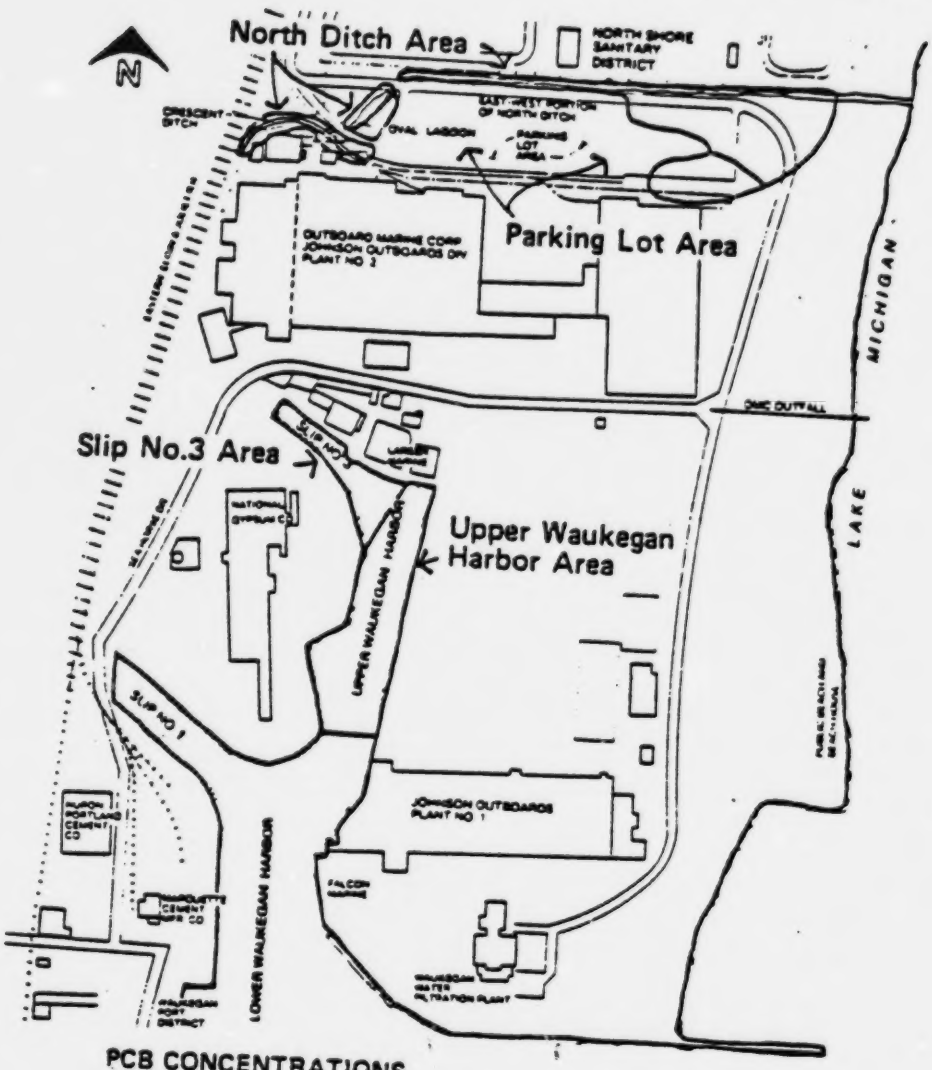

Site Map

Figure 1

discharge of the ditch between March and September 1979 as 1.8 cubic feet per second (cfs), with a maximum discharge of 5.3 cfs. They calculated the 5-year storm event to be 23 cfs.

The Parking Lot area is located north of OMC's Plant No. 2 and is about 9 acres in area. There are three entrances to the Parking Lot area: two fenced entrances in the northwest corner of OMC's property and one fenced entrance southeast of OMC's new die-cast complex at the intersection of OMC's private road and Seahorse Drive.

The generalized subsurface conditions in the North Ditch/Parking Lot area consist of typically 30 feet of compact, very fine to fine sand overlying a stiff to very stiff silt (glacial till). The thickness of the glacial till typically ranges from 50 to more than 100 feet.

B. EPA Work at the OMC Site.

High levels of PCBs in soil and harbor sediments in the vicinity of the OMC plant were discovered in 1976 and were found to have originated in the OMC outfalls. With this discovery, EPA and State of Illinois began a series of attempts to force OMC to cease discharging PCB and remove the PCB contaminated sediments from Waukegan Harbor and the North Ditch area. These attempts culminated in a suit filed against OMC by EPA to force OMC to dispose of North Ditch soils and dredge/dispose of contaminated Harbor sediments and a countersuit by OMC against EPA. As a result of these suits, EPA conducted a series of studies to assess the nature and extent of environmental problems in air, surface water, ground water, soils and sediments of Waukegan Harbor and North Ditch areas and southern Lake Michigan.

These studies included sampling studies:

An Engineering Studv for the Removal and Disposition of PCB Contamination in the Waukegan Harbor and North Ditch at Waukegan Harbor, Addendum to Final Report. Prepared for USEPA Region V, Chicago, Illinois. Lexington, Kentucky: Mason & Hanger--Silas Mason Co., Inc., May 1981.

Hydrogeologic Investigation, Outboard Marine Corporation, Waukegan, Illinois. Prepared for USEPA Region V and JRB and Associates. Madison, Wisconsin: Warzyn Engineering, Inc., September 20, 1979.

OMC Technical and Witnessing Case Support Hydrological Studv. of Ground Water, Final Report. Prepared for USEPA Office of Water Enforcement, Washington, D.C. McLean, Virginia: JRB Associates, Inc. February 10, 1981.

Sediment and Shore Sample Collection, Waukegan Harbor Slip #3. Prepared for USEPA Region V, Chicago, Illinois, and Mason & Hanger--Silas Mason Co., Inc. Madison, Wisconsin: Warzyn Engineering, Inc., May 26, 1981.

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The numerous investigations conducted over the years allowed EPA to accurately define the site in terms of the extent and quantity of contamination. The studies show that the OMC site is the largest uncontrolled potential source of PCB to Lake Michigan. More than one million pounds of PCB are present on site. The PCB is shown to be bioaccumulating in the fish in Waukegan Harbor and Lake Michigan. The modeling studies demonstrate that the PCB is leaving the site through movement of the surface water and ground water, volatilization to the air and transport of the sediment.

C. Concentrations of PCB Found in the Sediment:

Sampling data from Slip #3 showed PCB in concentrations up to 520,000 parts per million (ppm). It is estimated that more than 300,000 pounds of PCB are contaminating 10,000 cubic yards of sediment in Slip #3. Data from the upper harbor areas of Waukegan Harbor also show PCB contamination. It is estimated that approximately 5,000 lbs of PCB are present in 35,700 cubic yards of sediment in the upper harbor. The concentrations found in these sediments are much smaller than those found in the sediments of Slip 3; the highest concentration is 500 ppm PCB. Figure 2 shows the average concentration of PCB found in the various segments of Slip #3 and Waukegan Harbor.

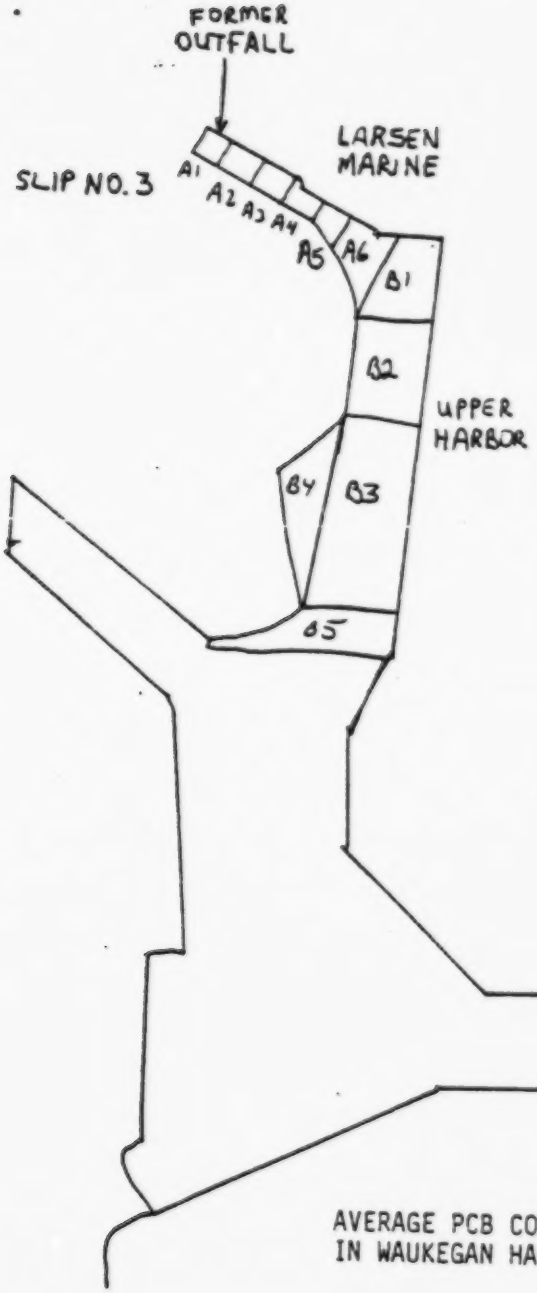
North of the OMC plant, the North Ditch area contains sediments with concentrations of PCB exceeding 35,000 ppm. It is estimated that 495,000 pounds of PCB are present in 70,800 cubic yards of sediment and soils in the North Ditch area. Finally, the area of the OMC parking lot contains approximately 277,700 pounds of PCB in 105,800 cubic yards of soil. The concentrations found in this soil range up to 5,000 ppm. Figure 3 shows the areas north of the OMC plant with concentrations of PCB greater than 50 ppm.

D. Mechanisms for PCB Release from OMC:

The sampling and modeling studies showed that PCB's are being released from the OMC site to the surrounding environment. Lake Michigan is the ultimate receptacle for most of the PCBs. The mechanisms by which the PCBs are being released include the air, through volatilization of the pollutant; the surface water, through the flushing of Waukegan Harbor and runoff through the North Ditch; the ground water, through the slow movement of the ground water towards Lake Michigan; and sediment transport, through the movement of sediment with surface and ground water. The rates of release of PCB through each of these mechanisms were explored in the investigations conducted by EPA.

1. Air

Although no air monitoring for the presence of PCB's was conducted at the site, modeling was used to estimate rates of volatilization of PCB from OMC. The concentration of PCB expected in solution at the sediment/water interface was estimated by mixing contaminated sediment in water, decanting the mixture and analyzing for the PCB concentration of the water. This concentration was used with transport rate equations to estimate the rate of volatilization from the site. A volatilization rate of 3.8 mg/m 2 / hr from a saturated solution (based on experiments conducted by General Electric in New York) was assumed. If volatilization is considered proportional to the concentration of PCB in solution, calculations based on the volitilization rate and the area of the site show that approximately 3.3 pounds of PCB per month are leaving the harbor portion of the OMC site through the atmosphere. Because that rate would vary positively with temperature, EPA estimates a total of 12 to 40 pounds per year of PCB are volatilizing from the harbor. In addition, it is estimated that the North Ditch contributes 15 pounds of PCB to the atmosphere per year.



Location	Average ppm PCB
A1	54,960
A2	31,318
A3	7,446
A4	7,446
A5	1,737
A6	538
Total A1-A6 (Muck)	
B1	183.2
B2	152.1
B3	96.6
B4	103.2
B5	30.0

AVERAGE PCB CONCENTRATION
IN WAUKEGAN HARBOR BY SEGMENT.

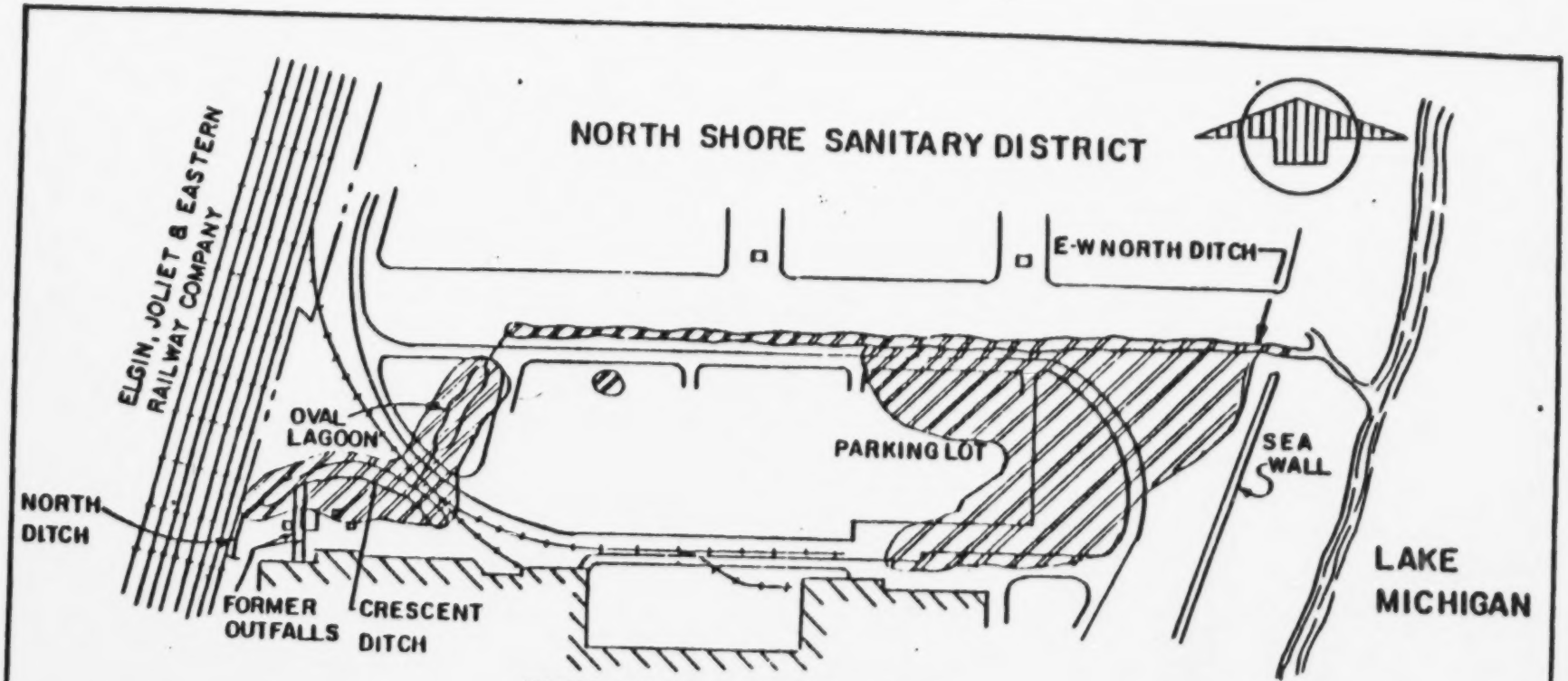


FIGURE 4

NORTH DITCH AREA

EXTENT OF PCB CONTAMINATION

OVER 50 PPM

2. Water & Sediment:

A great deal of monitoring was conducted to determine the concentrations of PCB found in the water column and sediments of both the harbor and the North Ditch. In Waukegan Harbor, concentrations in the water column ranged from a mean of approximately 6 parts per billion (ppb) about 300 feet from Slip 3 to a mean of .07 (ppb) at the mouth of the harbor. The concentrations in the sediments of the harbor are discussed above and shown in Figure 2. These water column concentrations were used with a mathematical model of the hydrodynamics of the Harbor to estimate the release of PCB to Lake Michigan resulting from PCB's dissolved in the water column and the transport of PCB-contaminated sediment under steady state conditions. The estimated rate of release is 22 lbs per year.

Sampling in the North Ditch shows the water column concentration, both dissolved and particulate, in that area to average 7 ppb. Again, this concentration was used with a mathematical model of the hydrology to estimate the PCB loading to Lake Michigan through the North Ditch. The rate of release from the North Ditch due to both dissolved PCB's and PCB-contaminated sediment is estimated to be about 7 - 20 lbs. per year. The results of the sampling of the soils and sediment is discussed above and shown in Figure 3.

In addition to monitored sediment data at the site itself, sampling of the surficial sediments in Lake Michigan indicate the presence of a "plume" of contaminated sediments moving from Waukegan. The shape of the "plume" strongly suggest that Waukegan is contributing to the contamination of Lake Michigan sediments. See Figure 4.

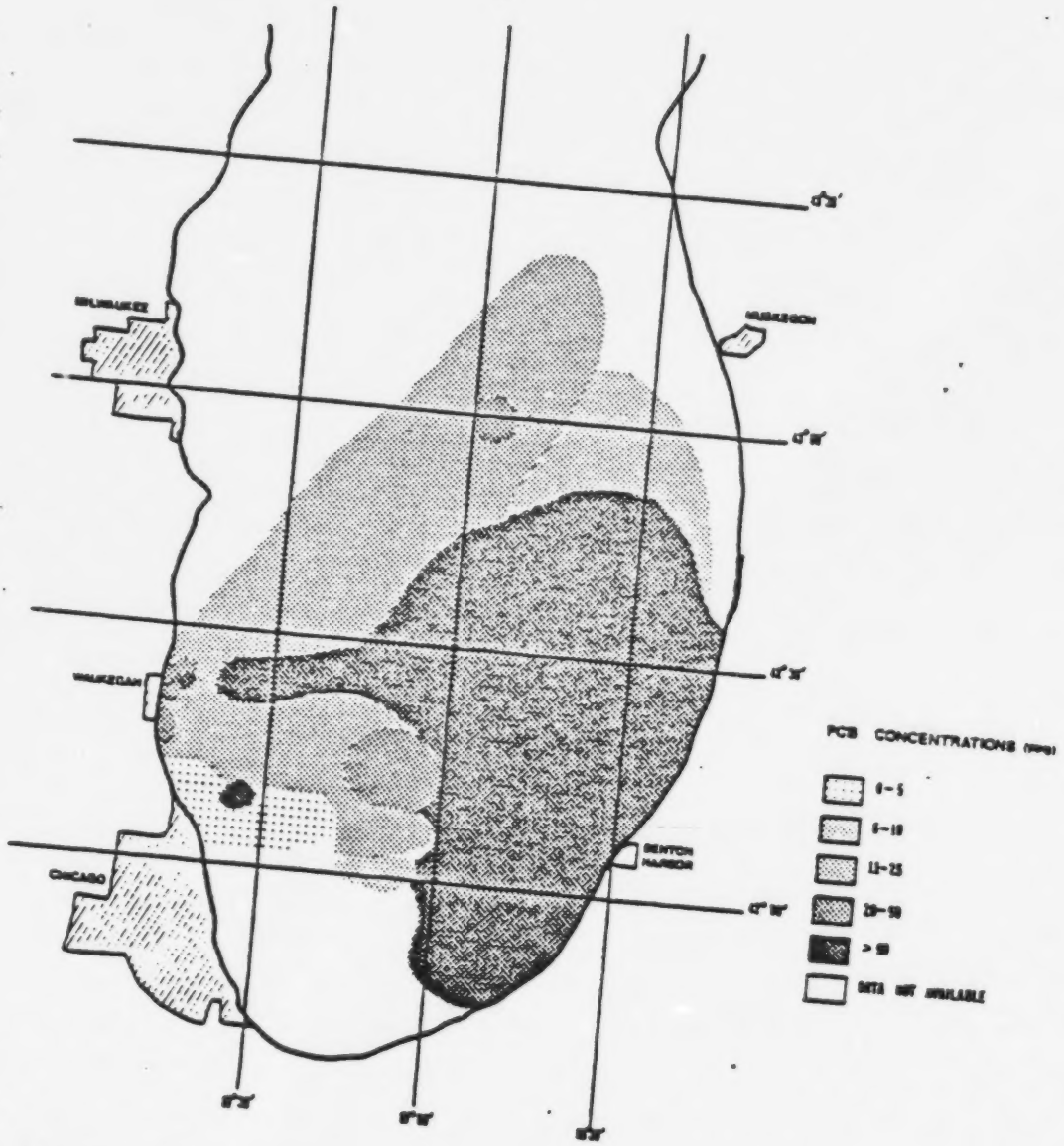


Figure 1-6. Generalized distribution of PCB concentrations in the surficial sediments of the southern basin of Lake Michigan. Derived from data gathered by Armstrong (1980).

3. Ground Water:

Extensive ground water contamination was documented in two comprehensive ground water monitoring projects conducted in 1979 and 1980. The studies showed PCB in the ground water in concentrations up to 35,000 ug/l. This studies showed the contaminated ground water is moving slowly toward Lake Michigan and will become a significant source to the Lake in 30 - 60 years.

The annual rates of release through each media from both the harbor and the North Ditch areas is shown in Table 1.

In addition to the annual release of PCB's from OMC due to normal transport mechanisms, the site represents a hazard to environment due of the possibility of a large, catastrophic-type release due to extreme storms. The modeling of steady PCB movements lakeward and the assumptions concerning summer season meteorological and hydrologic events do not take into account the potential of the violent Lake Michigan storms of late fall or winter which cannot, practically speaking, be measured and modeled. The lakeward movement of PCBs out of the Harbor during the winter may be underestimated and hence the range of annual PCB flux presented should be viewed as conservative.

In addition, the models cannot account for commercial navigation and recreational boating have the potential to disturb and expose highly contaminated materials, directly, through turbulence induced by propellors, These disturbances and the major storm events which generate turbulence in the Harbor may sustain the continued exposure of highly contaminated bottom sediments to the water columnn and hence will promote the surficial redistribution of PCBs throughout the Harbor.

Annual Rates of Release of PCB
from OMC
(Pounds/year)

	Air	Surface Water & Sediment	Ground Water
Harbor	12-40	22	N/A
North Ditch	15	7-20	N/A
Parking Lot	N/A	N/A	Future Release of 8 lbs/year

Table 1

E. Impact of the PCBs on the Use of Waukegan Harbor:

1. Generally

The presence of high levels of PCBs has prevented the dredging of the harbor since 1969 when they were discovered. Over the years, the harbor has continued to silt in, and its uses have deteriorated. Sailboat keels are hitting bottom. The Cement Company has indicated that its ore boats must travel with a half load in order to access the Harbor. Without removal of the sediment the Harbor will continue to lose value to businesses which depend upon it.

In contrast to the dim prognosis for the future, both the City of Waukegan and the Port Authority have massive development plans for the harbor area. This includes condominiums, boat ramps, new streets and a total upgrading of the area. Currently, the City is completing a new 750 slip marina.

Conversations with the Port Authority have indicated that the issue of uncontrolled PCBs had had adverse impacts on economic development. Implementation of a PCB control will allow the development plan to proceed.

The Corps of Engineers, the Waukegan Port Authority and U.S. EPA are interested in implementing individual projects, which together will result in a program that addresses all areas of the harbor and will offer a long term resolution to the problem. The Corps of Engineers wants to establish a regular maintenance dredging program for the harbor where open lake disposal of dredge spoils can be utilized in future years. Unless the contamination is removed above their project area, this goal cannot be realized because PCB contaminated sediments will continue to migrate into the area that the Corps dredges. The high levels of PCBs in the harbor is preventing the Corps of Engineers from implementing a maintenance dredging project which is needed to bring the harbor back to its

full use. This is having an adverse effect upon the welfare of the local community.

2. Socio-economic

A cursory survey of the employers in the Harbor area indicates that much of the economic activity either is water-dependent or water-related. The Outboard Marine Corporation (manufacture of non-electrical machinery), Larsen Marine (marine sales and services), Falcon Marine (marine contractor), Waukegan Port District (transportaion services), the Waukegan Yacht Club (recreation) and the Waukegan Water Filtration Plant (public water supply) depend upon the Harbor and Lake Michigan for their operations. Huron Cement, and Gold Bond, both of which are Divisions of National Gypsum; Larsen Marine; Falcon Marine; the Waukegan Port district and the Waukegan Yacht Club depend upon a working harbor for their operations.

The Waukegan Port District operates the Waukegan Harbor. The Port District's gross revenues during 1980 totalled $286,950. The sources of there revenues are shown below:

Gasoline	$13,000
Land leases	64,000
Slip rental	78,000
Dry moorings	35,000
Wet moorings	8,200
Slip hopping	14,000
Parking lot fees	16,000
Boat launching	31,000
Charter Boat permits	6,500
Temporary docks	7,800
Interest	7,500
Miscellaneous	5,950
TOTAL	$286,950

During 1980 there were approximately 43 commercial ship dockings at Waukegan Harbor (By telephone Mr. Bruce Lawson, Deputy Director, Waukegan Port District

and Ms. Susan Du Bois, Gold Bond to WAPORA, Inc. 19 October 1981). Shipping activity in the Harbor varied widely from 1969 to 1980. The number of tons of cargo hauled over the 11-year period ranged from 588,866 in 1971 to 282,500 in 1980 (US Army COE n.d. and Waukegan Port District 1981). The decline in shipping activity during 1980 reflects the nature of the Port shipping activity during 1980 reflects the nature of the Port District's commercial clients.

The Port District currently serves two commercial clients: Huron Cement and Gold Bond. Huron Cement is located on the northwest side of the Harbor between Slip #3 and Slip #1. Gold Bond is located south of Slip #1 (Figure 1-2). During 1980, 282,500 tons of bulk cement and gypsum rock were hauled into the Harbor for these two clients, respectively. Because Huron Cement and Gold Bond both supply building materials for the construction industry in the Chicago metropolitan area their need for raw materials is directly related to the level of construction activity taking place. During 1980 and 1981, construction activity in the Chicago area was relatively slow, and shipping activity at Waukegan Harbor likewise declined. Huron Cement and Gold Bond both dock at Slip #1 to unload cargo. Depending upon the size of the ship, Gold Bond's ships either back out of the Harbor or back around into Slip #3 to swing the bow around. Huron Cement's ships back around into Slip #3 and leave the Harbor bow first.

Falcon Marine is located on the east side of the Harbor adjacent to the Waukegan Water Filtration Plant. Falcon Marine docks between four and eight barges along the seawall. The barges are between 30 and 42 feet wide and 100 to 120 feet long.

Many types of recreation facilities and opportunities are available in the Waukegan Harbor area; the foremost of these is fishing. The Illinois Department of Conservation, Division of Fisheries and Wildlife has estimated that Waukegan Harbor and offshore areas experience the heaviest fishing pressure of any area along the Illinois coastline of Lake Michigan. Although the majority of the recreational uses of the Harbor are related to fishing, a substantial amount of pleasure boating, sailing, picnicing, and other water-related activities also take place.

The 10 public boat launching ramps at the Harbor are open for use on April 1 each year and the 117 slips and 41 mooring cans are open by 1 May. There also are 75 dry parking spaces for boats. Demand for the boat moorings is quite high, and the current waiting listed contains more than 600 applications.

A considerable amount of boat-launching activity occurs at the Harbor. During the period April 1981 through 31 July 1981, 5,755 boat launching tickets were sold (a $3 fee is charged). This does not account, however, for the approximately 450 season-pass holders who have unlimited boat launching privileges.

Larsen Marine Service, Inc., is located adjacent to Slip #3 at the north end of Waukegan Harbor and is the largest lakefront yacht dealer in the Chicago metropolitan area. Because Waukegan Harbor is the only protected public harbor along the northern Illinois shoreline, a large amount of recreational boating activity is concentrated there. Larsen Marine is the only marine sales and services company located directly on Waukegan Harbor. The company provides yacht brockerage for new and used power boats and sailboats and offers complete marine repair services. A crane operated boat hoist is also available for removal and storage of all size classes of boats. These services are of

considerable importance to recreational boaters in the region because there are no similar commercial facilities on the northern Illinois coastline.

Currently, the Illinois Department of Conservation limits the number of charter boats which operate out of Waukegan Harbor to 35. Of this total, 27 are members of the Waukegan Charter Boat Association; members include eight 4-passenger boats and nineteen 6-passenger boats. The Charter Boat Association estimates that its 27 boats have between 12,000 to 15,000 paying clients.

This boating activity results in substantial fishing pressure. There are 14 public boat access points along the Illinois shoreline to serve the entire metropolitan region. Although Waukegan is 40 miles north of Chicago, the major population center of the region, the Waukegan area experienced the greatest fishing pressure along the entire Illinois shoreline of Lake Michigan. This estimation is based on a 1979 sport fishing creel survey conducted along the Illinois portion of Lake Michigan by the Illinois Department of Conservation.

The results of the creel survey indicated that the heaviest pier/breakwater fishing pressure was experienced at the Waukegan Harbor and that the heaviest boat fishing pressure was experienced offshore from the Waukegan Harbor. The survey personnel estimated that a total of 222,918 angler hours were expended for pier/breakwater fishing along the Ilinois shoreline. At the Waukegan Harbor, the 1979 estimate of angler hours was 45,974, or 21% of the total. However, the average number of fish caught per hour at the Waukegan Harbor was the second lowest rate of the 14 sites listed.

The estimates for the trolling fishery also indicated that more angler hours were expended in the Waukegan Harbor area than at any of the other locations. Of the total 601,426 estimated angler hours spent trolling, 184,554 (31%) were

allocated to Waukegan Harbor. As for the pier/breakwater fishery, the number of fish caught per hour was relatively low. The majority of the fish caught by both pier/breakwater and trolling fishing were coho salmon. Half of all the coho caught from the pier/breakwater fishery were from Waukegan Harbor. The Waukegan Harbor trolling fishery accounted for 34% of all the coho salmon caught along the Illinois shoreline in 1979.

Although significant fishing activity took place on the Waukegan breakwater and from boats in 1979, relatively little shore fishing occurred at the Waukegan Harbor. Of the 285,374 angler hours estimated for the 1979 shore fishery, only 1,179 (0.4%) were allocated to the Waukegan Harbor.

II. TOXICITY OF PCBs

The toxicity of PCBs to humans was demonstrated graphically and tragically in 1968 when rice oil in Yosho, Japan, was accidentally contaminated with PCBs. Since then, extensive information has been collected concerning the toxicity of the different types of PCB compounds in varying concentrations. The compounds have been found to be toxic and uniquely persistant in the environment and the human body.

The best summary of the information available on the toxicity of PCB was compiled in August 1982 by the Health and Environmental Review Division within the Office of Toxic Substances for the TSCA rulemaking on PCB. This summary of health information concludes that PCBs are linked to a myriad of health and environmental problems, including the following:

- o carcinogenic effects in rodents - especially liver cancers.
- o immunosuppressive activity.

- o Tremendous bioaccumulation of PCB occurs in the food chain Fish flesh often contains several thousand times the concentration of PCB found in the ambient water.
- o ambient exposure impairing reproduction potential of commercial fisheries and mink.
- o high PCB levels found in birds, especially in gulls and other carnivorous birds.
- o chloroacne - a painful, scarring disease that is frequently accompanied by other problems including deformity of bones and teeth, headaches, dizziness, fatigue, abdominal pain and vomiting.
- o adverse affects on the menstrual cycle of rhesus monkeys.
- o changes in menstruation in humans.
- o reduction in rate of conception, reduction in implantations, difficulty in carrying offspring to term.
- o PCBs are inducers of hepatic microsomal enzymes (role of producing sex steriods).
- o increase production of androgen and testosterone in rats.
- o increased liver to body weight ratios in rabbits.
- o the uteri of 1,254 rabbits were about 1/2 the size of the control group after exposure to PCBs.
- o Reproduction in mink appears to be extremely sensitive to PCBs; reproduction was totally inhibited at an exposure of 5 ppm for 10 months.
- o PCBs have been shown to cause adverse effects to test animals in all four areas of tertogenicity, which includes 1) death to the developing organism, 2) structural abnormalities, 3) growth retardation and 4) development of functional deficiencies.
- o PCBs have been found in mothers milk. Infants PCB concentrations increase with exposure time and may cause morphological alterations of the liver at the ultracelluar levels and increased susceptability to viral infections because of increased immunosupressive activities of PCBs.
- o Infant monkeys have died prior to weaning when exposed to PCBs because of rudimentary thymuses, small spleens and lymph nodes.
- o excess liver cancer deaths observed in workers exposed to PCBs at high concentrations.
- o PCBs induced lesions in the digestive tract which may be precursors to carcinomas.

III. THREATS TO PUBLIC HEALTH AND THE ENVIRONMENT POSED BY PCBS AT THE OMC SITE

A. Threats to Public Health:

A toxic compound or chemical poses a threat to public health only to the extent that the public is exposed to the compound or chemical. Risk is always a function of toxicity and exposure. PCBs have been shown to be toxic. There are several routes by which the public is exposed to this toxic compound at the OMC site and by which is released to Lake Michigan. These routes of public exposure are discussed below.

1. Drinking Water

The City of Waukegan maintains an emergency drinking water intake in Waukegan Harbor. Although this intake is rarely used and has been used only six times in the last fifteen years, it is an integral component of the Waukegan Water Supply. Should the City need to utilize the emergency intake, PCB contaminated sediment and water may be introduced into the drinking water system. The City has its main drinking water intake about 1 mile off shore in Lake Michigan. At the request of the Lake County Health Department, USEPA conducted a survey of the water supply for PCB's. USEPA sampled the raw water, finished water, and drinking water sludges. Low concentrations of PCB's were found in the drinking water sludge samples. This indicates that PCB's are getting into the system, but are being adequately removed by the treatment system.

2. Ingestion of Contaminated Fish

The waters of Lake Michigan are heavily fished for both commercial sale and sport. The near shore area adjacent to the OMC site is often fished. A 1979 sport fishing creel survey by the Illinois Department of Conservation indicates that the Waukegan Harbor area accounts for 21% of the angler hours expended in

Illinois for pier/breakwater fishing (45,000 hours). Even Waukegan Harbor itself, although "No Fishing" signs are displayed, has occasionally been used for fishing. All fishing near the site, both in Waukegan Harbor and Lake Michigan presents a potential public exposure to PCB because PCBs are bio-accumulated by fish from the water in which they live and from the insects and plants they ingest. It has been demonstrated that fish bioaccumulate PCBs by 100,000 or more times the ambient water concentrations.

In USEPA studies on Lake Michigan fish, results ranged from concentrations of 2.7 ppm to 187 ppm PCB in fatty tissue for all species. Although it is impossible to determine the exact source of these PCB's, clearly PCB in Lake Michigan fish is a problem and clearly the OMC site is a source of PCB to the Lake.

It is very difficult to calculate the extent of human exposure to PCBs through the consumptions of contaminated fish because the levels of PCBs in fish differ significantly as does the amount of fish consumed by different persons. Based on a study conducted by the Michigan Department of Public Health (Cordle, et. al., 1978), it is considered likely that persons who consume large amounts of contaminated Lake Michigan fish are exceeding the recommended daily limit. Based on the Clements Associates study on the "Health Risks Posed to Consumers of Fish Contaminated with PCB's from Lake Michigan" (1981), heavy consumers of Lake Michigan fish contaminated with PCB may be exposed to a one in one thousand excess risk of developing cancer with a lifetime of exposure. Obviously, those who consume fish from the highly contaminated Waukegan Harbor area are also likely to be exceeding the recommended daily limit for PCB consumption.

3. Dermal Exposure

Another route of public exposure to the PCBs at the OMC site is related to the recreational and commercial activities conducted around the site. Pleasure

boats moored, launched and then removed from Waukegan Harbor are coated with contaminated harbor muds and silts. Boat owners and workers are exposed to PCBs when they work on the boats. Boats may be removed from the Harbor, brought to the owner's home and washed, spreading PCB contaminated material to the owner's property.

In addition, the North Ditch discharges to a beach area, meandering across the sand until it reached Lake Michigan. The public has access to this beach for walking or playing.

Because of the level of public activity in and around the OMC site, public exposure to PCBs through the skin is likely.

4. Inhalation

As was discussed above, PCBs are volatilizing from the OMC site in significant quantities. These volatile PCBs present yet another route of public exposure. Twelve percent of Waukegan's work force is employed adjacent to the harbor. In addition, many people utilize the harbor for recreational boating about eight months per year, with numbers peaking in the hot summer months when volatilization is highest. A recreational beach is located due east of harbor. The prevailing winds blow east and thus beach users are likely to be exposed to PCB contamination.

B. Threats to the Environment:

In addition to the threats to public health posed by the site, the PCB's at the OMC site present a significant threat to the environment of Waukegan Harbor and Lake Michigan. As described above, water samples taken from Waukegan Harbor and the North Ditch have mean concentrations of PCB of 0.6 ppb and 7.0 ppb, respectively. The USEPA Ambient Water Quality Criteria for the protection

of fresh water aquatic life from chronic toxicity due to PCB is 0.014 ppb. Water column concentrations at the site far exceed the ambient water quality criteria. The concentrations found in water samples taken in Lake Michigan offshore from Waukegan Harbor showed PCB concentrations at 0.01 ppb, slightly less than the water quality criteria.

Research has shown that small amounts of dissolved PCB's, such as those found in Lake Michigan, can inhibit phytoplankton photosynthesis (McNaught et al. 1981). Because phytoplankton are at the base of the Lake Michigan food chain, inhibition of phytoplankton photosynthesis will limit the poundage of sport fish that can be produced in the Lake. In one experimental study, PCB concentrations of 5 ng/l inhibited nanoplankton photosynthesis by 5.7% (McNaught et al. 1981). Concentrations of 100 ng/l and 500 ng/l inhibited nanoplankton photosynthesis by 8.9% and 18.9%, respectively (McNaught et al. 1981). PCB concentrations of 5 ng/l are comparable to the levels found in the open waters of Lake Michigan, and concentrations of 500 ng/l are comparable to present levels in Waukegan Harbor.

The PCB's in Waukegan Harbor present a special danger to immature fish. To ensure a self-sustaining community of fish, a certain critical percentage must survive from the larval stage to maturity. If the critical percentage that must reach maturity is not attained, fish population will decline and a stocking program will be required to maintain the population. If the cause of the decline is not corrected, a continual stocking program is required. Wilford (1980) found a direct correlation between fish fry mortality rates in Lake Michigan lake trout and PCB and DDE levels in the water column.

Concentrations of PCBs in Waukegan Harbor are not evenly represented by the water column levels. PCBs tend to concentrate at levels above those found in the water column in two sections: the surficial bottom sediment and the air/water interface. Increased concentrations in these sectors result from the tendency of PCBs to partition into organic compounds by adsorption. The organic fraction can move PCBs downward with settling particulate matter or upward into the plankton, oil, and foam at the air/water interface, and held there by what is generally referred to as "the surface film effect." Bottom sediments are used as a food source for bottom feeding fish and are commonly the depository for developing eggs and larvae when used as a spawning ground. In addition, the surface film is a rich food source to many types of young fish (Wangersky 1976). Although documentation does not yet exist, it is speculated that an increased biological hazard exists for fish feeding on bottom dwelling organisms of Waukegan Harbor and outlying water, or using the Waukegan area sediments as a spawning ground.

In the central Waukegan Harbor area, fish would encounter PCB concentrations in the surficial sediments that range from 8 to 3,600 ppm (Armstrong 1980) and which are more than 20,000 times more concentrated than the levels typically found in the Waukegan Harbor water column. Although no PCB concentration data are available for the surface film sector of the Harbor, the known affinity of PCBs to become adsorbed into organic compounds and the increased presence of such compounds at the air/water interface suggests that PCBs may have an increased adverse impact on the biota through this sector.

Only twenty-nine fishes (9 total species, 6 game species) have been captured in Waukegan Harbor for the purpose of determining bioconcentration factors for PCBs. The relative scarcity of some fish in the Waukegan vicinity as

evidenced by the low number of species captured may be related to the high levels of PCBs and other pollutants found in the area.

In an effort to show the environmental impact of the OMC site of Lake Michigan, the movement of PCB's from the project area to the Lake was compared for the input of PCB's to the Lake from other sources. The vast size of the lake makes this sort of analysis misleading; Lake Michigan is so large even 55 lbs or so per year from a single source does not appear significant. A nearshore sector with a 10 kilometer radius was selected as an area of localized impact outside Waukegan Harbor.

Although the 10-kilometer radius area was selected arbitrarily, it represents a reasonable-sized area that excludes possible influences from other sources such as the City of Chicago to the south. The area of the Lake within this radius also coincides roughly with the eastward extent of the unstratified, nearshore zone of Lake Michigan. The long-term average PCB mass load from the combined Waukegan Harbor/North Ditch system to Lake Michigan may be conservatively estimated to be 22 to 44 pounds per year (modeling of water and sediment only). If it is assumed that the dry deposition load of PCBs to the entire Lake is approximately 550 to 1,100 lb/yr and that rainfall and dry deposition are uniform over the Lake (USEPA 1981), then the 22 to 44 lb/yr PCB load from the Waukegan Harbor/North Ditch area could represent from 49% to 80% of the total load to the near-shore (10 km) sector. See Figure 5.

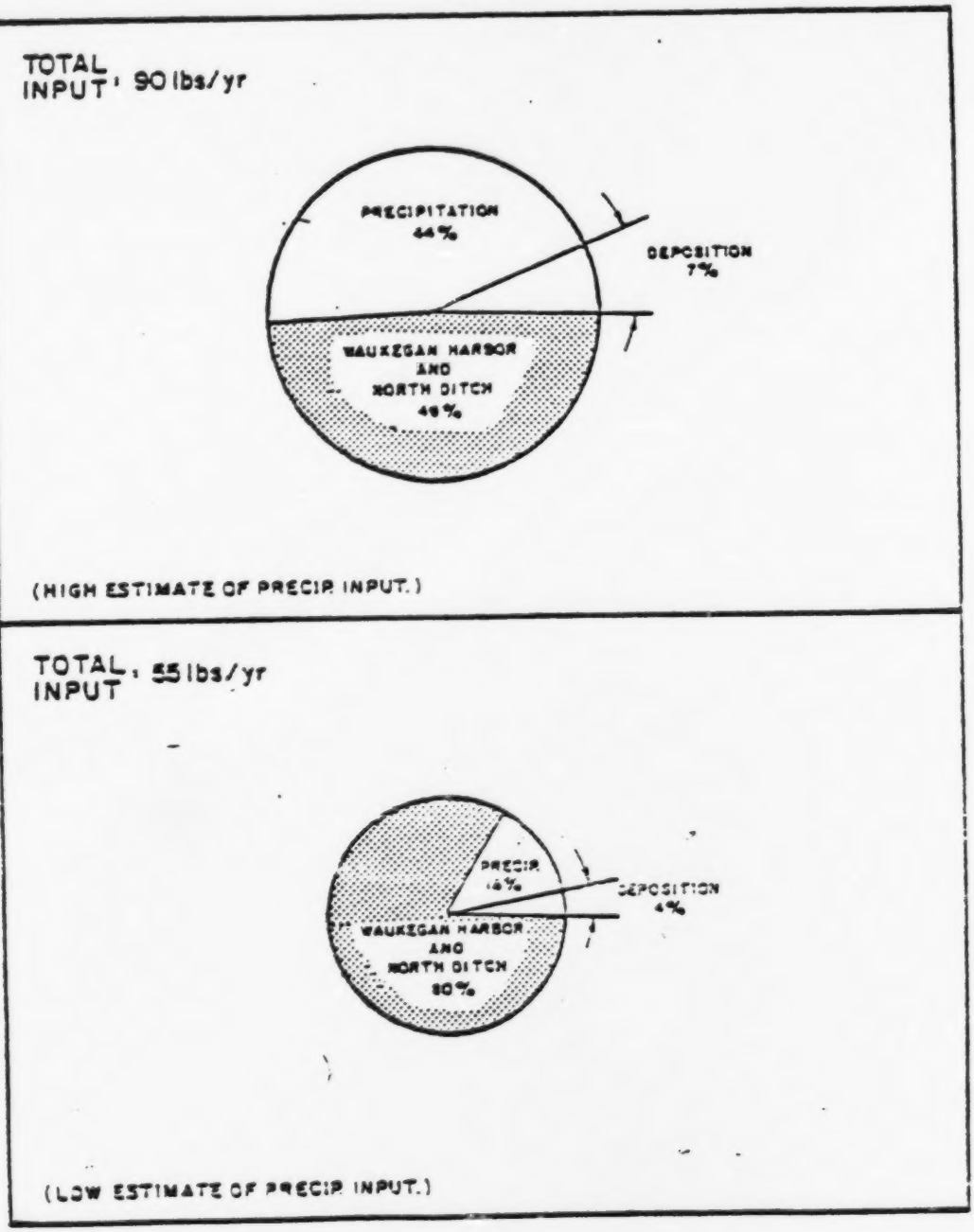


Figure 5

The range and distribution of the total PCB loads to the nearshore sector of Lake Michigan adjacent to Waukegan Harbor (HydroQual 1981).

IV. EVALUATION OF THE "NO ACTION" ALTERNATIVE

Studies conducted by EPA have shown that high concentrations of PCB exist in all segments of the OMC site (Waukegan Harbor, North Ditch, and the OMC parking lot). In addition, sampling and modeling studies have shown that the PCB's are leaving the site through the flushing of water from the Harbor and the North Ditch, the movement of ground water toward lake Michigan, the transport of sediment into Lake Michigan and the volatilization of PCB's to the atmosphere.

Under the NCP, source remedial actions are appropriate if a substantial concentration of hazardous substances remain at or near the area where they were originally located and inadequate barriers exist to retard migration of substances into the environment.

A source control action is appropriate at the OMC site because the investigations regarding the human health and environmental impacts of exposure to PCB's have shown that PCB's are both toxic and uniquely persistant. The release of PCB from the site was evaluated and it was determined that the release is resulting in a public exposure to PCB. These evaluations showed that the public is being exposed or potentially exposed to the PCB's released from OMC though the drinking water supply, consumption of contaminated fish, skin contact with contaminated material, and inhalation of volatilized PCB's.

In addition, the PCB's being released from OMC are having a negative impact on the environment of Waukegan Harbor and the nearshore area of Lake Michigan. Finally, a no action alternative may result in indefinite postponement of the dredging of the navigation channel. If routine channel dredging were precluded, deep draft shipping activity would eventually cease as a result of sedimentation at the Harbor mouth.

Although the economic contribution of the Harbor industries that are dependent on a working harbor for their operations to the overall economy of the area has not been quantified, the impacts associated with a further curtailment in use of Harbor would be substantial. Such a curtailment would be expected if no action was taken to abate PCB contamination in the Harbor because of the potential hazards associated with Harbor maintenance activities.

Because of the known and potential threats to public health, welfare and the environment specified above and associated with the release of of PCB's from the OMC site, remedial action has been determined to be necessary to provent and mitigate the migration of PCB's from the site and the spread of PCB's to Lake Michigan and the food chain.

Under CERCLA, the remedial action taken to control the PCB's must be determined to be cost effective based on engineering, environmental and economic criteria. EPA conducted a feasibility study to evaluated the potential remedies for the site.

V. FEASIBILITY STUDY

A. Extent of Remedy:

Before assessing the various options, it is necessary to consider the quantity of contaminated soil or sediment to be controlled. The quantity is dependent on the concentrations of PCB which must controlled to protect the public health and environment. EPA has determined that all soil and sediment contaminated to 50 ppm or greater must be controlled. This limit was based upon modeling of the Harbor done by Hydroqual (1980). Using a hydrodynamic model of water and sediment transport, Hydroqual estimated the flux of PCB to Lake Michigan

if sediments in the Upper Harbor and Slip No. 3 are contaminated with 500, 100, 50, 10 and 1 ppm PCB. The modeling studies showed that if all sediments contaminated to greater than 100 ppm are contained or removed from the Harbor and steady state conditions are assumed, the flux of PCB to Lake Michigan will approach zero, the water column concentrations in the Harbor itself will be reduced to less than 0.02 ug/l, the ambient water quality standard, and fish residing in the Harbor will not accumulate PCB to greater than 5 ppm, the FDA standard.

These modeling studies did not address the turbulence introduced into the Harbor by boat traffic and heavy storms, however, and this turbulence may introduce as much as 2 pounds per year of PCB would be released to Lake Michigan if the sediments are contaminated to 100 ppm. To lower the estimated release of PCB from the Harbor and provide some margin of safety for the fish in the Harbor, it is necessary to dredge so that the sediments remaining will have concentrations of PCB less than 50 ppm. Although there is no modeling available for the area north of the OMC plant, considerations similar to those regarding the Harbor area suggest that 50 ppm is an appropriate level of cleanup for the whole site. In addition, such a level of cleanup would ensure that the material excavated as part of construction of the slurry walls would not require off-site disposal at a chemical landfill. Finally, a 50 ppm level of cleanup provides a consistant objective for the cleanup of the entire site.

B. Screening of Alternatives

To determine the most effective way to clean up the sediments contaminated to greater than 50 ppm PCB. EPA evaluated more than fifty treatment alternatives and technologies. These alternatives included in place destruction of the PCB with UV/ozonalysis, biodegradation and oxidation; in-place fixation with

sorbents and seals; in-place separation of the PCB and removal; removal of the contaminated soils and sediment; alternatives to bypass the contaminated material; water treatment technologies; onsite storage and offsite disposal or storage/ disposal.

Although there is a lot of research on innovative methods of destroying or fixing PCB's and several alternatives are potentially promising, there are relatively few technologies that have been proven to be effective on PCB contaminated soil and sediment. In reality, the only proven feasible technologies approaches available are the traditional alternatives of (1) excavation and offsite disposal or incineration and 2) containment of the material on site. The offsite option of incineration was screened out because it was judged to be an order of magnitude more expensive than land disposal. Thus, the two options evaluated in detail were offsite disposal in a landfill, and onsite containment. The variations on these primary alternatives were evalutated in detail to determine the best way of accomplishing each option. The combination of treatment technologies considered most appropriate for each of the two generic alternatives is described below.

C. Excavation and Offsite Disposal:

If implemented in Waukegan Harbor, an offsite disposal option would require several steps. A sediment dispersal control device would be installed across the south end of the upper Harbor to ensure that sediment disturbed during dredging does not escape to Lake Michigan. Sediments contaminated with PCBs would be removed with a hydraulic dredge (a suction line) and the sediment slurry pumped through a pipeline to an initial solids dewatering lagoon.

Because the hydraulic dredge cannot penetrate the area of deep contaminated sand and silt near the OMC outfall, a mechanical dredge inside a single sheet pile cofferdam would be used to remove this material.

The dredged solids would be dewatered, fixed and transported to a disposal site meeting TSCA standards for PCB's. All removed water and process water would be routed to a water treatment plant for suspended solids and PCB removal (to 1 ppb PCBs, an effluent standard based on Best Available technology from the Mason and Hanger analysis), then discharged to the harbor or to a sanitary sewer. During excavation and dewatering, volatiliation of PCB's is likely to increase because the highly contaminated sediments will be exposed. This volatilization will be temporary and will be minimized by using best management practises.

In the areas north of the OMC plant, the excavation and off-site disposal would be somewhat simpler because underwater dredging would not be necessary. A bypass would be constructed to divert surface water flow around the highly contaminated areas of the Crescent Ditch and Oval Lagoon directly to Lake Michigan. The soils would be dewatered in place using well points and pumps, excavated with a backhoe or front end loader, fixed with portland cement or another fixing agent, cured and transported to a disposal site meeting TSCA standards. Well water would be routed to an onsite water treatment plant for suspended solids and PCB removal (to 1 ppb PCBs), then discharged to the lake or to a sanitary sewer. Because the material in the Parking Lot area is not expected to be flowable, the intermediate step of hydrating the soil with a fixing agent is considered unnecessary. During excavation, the volatilization of PCB's is likely to increase beause the highly contaminated soils will be exposed. This volatilization will be temporary and will be minimized by using best management practises.

The excavation and offsite disposal options are the most reliable remedial alternatives for the OMC site. The OMC site is located immediately adjacent to Lake Michigan. The Waukegan Harbor portion of the site is hydrologically connected to Lake Michigan and the northern areas of the site have ground water only three feet below the surface. Sediment and soil from the area is continuously transported to the Lake. By excavating and removing the PCB contaminated material from the site, the transport of PCB to the Lake, and the accompanying threat to public health and the environment is stopped. There will no longer be high concentrations of PCB adjacent to the lake so all of the threats described earlier are eliminated. Under this alternative, the PCB contaminated material would be disposed of in a chemical landfill as defined under the PCB regulations (40 CFR 761). This type of landfill is designed specifically to contain hazardous material and is located so that the physical environment will not act to deteriorate the containment cells. The EPA, by promulgating the PCB regulations, has established that chemical landfills as defined in the PCB regualtions are safe, reliable receptacles for PCB contaminated material.

D. Containment On-Site

The other generic type of alternative available for dealing with the PCB contaminated material involves containing the material on-site in such a way that the release of PCB's to Lake Michigan is prevented. There are two basic ways to contain the material onsite; a lined landfill meeting the requirements of TSCA onsite or a containment cell using the existing glacial till as a bottom.

Upon analysis of the TSCA landfill option it became apparent that it is impossible to build a disposal facility meeting all of the TSCA requirements and it is

complicated and expensive to build one approximating those requirements. It is impossible to build a TSCA landfill because such a facility must be placed "above the historical high ground water table." In addition, "floodplains, shorelines ... shall be avoided". The location of the OMC site and the high ground water table in the area make it impossible to comply with these two requirements. Construction of a disposal facility approximating such a landfill would be difficult because installation of a liner would requirelarge quantities of soil and sediment be excavated, stored onsite while the liner is installed and disposed on the lined area. The logistics of the excavation and temporary storage of the contaminated material made such an option much more complicated and expensive than the other onsite option, a containment cell using the existing glacial till as a bottom. The environmental problems presented by this option are judged to outweigh any environmental benefit presented by the liner.

A slurry wall extending into the glacial till would be constructed tying into the glacial till around the entire perimeter of the containment area. This slurry wall will seal the sides of the containment cell and the impervious glacial till found beneath the slip will seal the bottom of the cell.

Dredged sediments from Slip 3, Upper Harbor, Oval Lagoon, and Crescent Ditch and excavated soil from the parking lot would be placed within one or more of containment area. Supernatant from dewatering these solids would be continuously decanted and routed to an onsite water treatment plant for suspended solids and PCB removal (to 1 ppb PCBs), then discharged to the harbor or to a sanitary sewer. During dewatering, volatilization of PCB's is likely to increase because the highly concentrated sediments are exposed. This volatilization will be temporary and will be minimized by using best management practices. After dewatering, the containment cell or cells would be sealed with a three foot

impermeable clay cap. Ground water monitoring wells would be installed around the site for detection of any future PCB migration.

In the area north of the OMC plant, a gravity pipeline bypass would be constructed to divert surface water flow around the highly contaminated areas, the Crescent Ditch and Oval Lagoon. This bypass would collect drainage from the storm drain (that flows north at the west edge of OMC's property), from OMC plant roof drains, and from regraded areas north and south of the Crescent Ditch and discharge it to Lake Michigan.

It would be constructed south of the sheet piling just north of the east-west portion of the North Ditch. The Parking Lot area would be regraded to divert surface water flow to catch basins.

Containment will effectively control the major mechanisms for the release of PCB from the OMC site. The volatilization of PCB will be prevented because the containment cells will be capped with several feet of impervious material. The transport of contaminated sediment will be eliminated because the sediment will contain behind impermeable slurry walls. Finally, the contamination of surface water with PCB will be eliminated because the water will no longer be in contact with PCB contaminated sediment.

Because no slurry wall is completely impermeable, the containment cells will release very small quantities of PCB very slowly to the ground water. Based on an overall permeability of 10^{-7} cm/sec, migration of PCB's through 2 ft slurry walls around the containment cells will disperse about 0.003 lbs of PCB per year. Assuming the same permeability for the glacial till, migration through a one foot layer of glacial under all the containment areas will disperse about .03 lbs per year. If cracks occur in the slurry wall or if pockets of

permeable material are present in the glacial till, this dispersion will occur faster. These rates of dispersion, however, are much less than the 55 - 100 lbs per year EPA models shows are being released under present conditions.

VI. THE COST EFFECTIVE REMEDY

Because of the problems of reliability of containment cells built in proximity to Lake Michigan, containment is considered less effective than offsite transport and disposal of the PCB contaminated material at a chemical landfill as defined by the PCB regulations.

The Environmental Protection Agency has consistently held that the public health risks associated with PCB's, particularly high concentrations of PCB's, are such that the release of PCB's into the environment must be strictly controlled. Because it is impossible to build a TSCA landfill on a site adjacent to and in Lake Michigan, containment on site is not consistent with the Agency's basic regulatory position regarding PCB's or EPA's definition of cost-effectiveness in the National Contingency Plan. Thus, the excavation and offsite disposal option is considered the only remedial action for the OMC site which effectively mitigates and minimizes risk to public health and the environment.

In defining the most cost-effective technique for accomplishing excavation and offsite disposal, several options were evaluated. These options involved alternative methods of dewatering the material dredged and excavated from Waukegan Harbor and the area north of the site. The options available for the dredged sediments in the Harbor are:

1. Dredge - Dewater in Lagoon - Fix - Dispose
2. Dredge - Dewater in Barges - Fix - Dispose
3. Dredge - Dewater in Lagoon - Dispose

Option 2, which requires dewatering of the sediments in barges is not a feasible option for the extremely large quantities of material which will be dredged from the Upper Harbor area. The minimal savings in dewatering the dredged sediments from Slip 3 in barges would be offset because the simplicity of one technique and economies of scale attained by treating the sediments in the Slip and the Upper Harbor in the same fashion would be lost.

Option 3, would depend upon evaporation to dewater the dredged sediments. Although this is technically feasible, the evaporation would result in significant quantities of PCB being volitilized from the highly contaminated sediments. It is estimated that as much as 63 pounds/day PCB would volitilize during dewatering. The public health and environmental impacts of this remedy are too significant to consider it any further.

The most cost-effctive remedy for the excavation and disposal of material from the Waukegan Harbor is to Dredge -Dewater in Lagoons - Fix and Dispose.

For the contaminated material north of the site, there are options for excavating and dewatering the material. These options are:

Excavate - Dispose
Excavate - Fix - Dispose

The fixation step is necessary to ensure that the material is not flowable, that is, that it will not spill as a liquid. The materials to be removed from the Oval Lagoon/Crescent Ditch area are expected to be as wet a dredge spoils and, as such, the material will need to be dewatered or "fixed" before it is safe to transport it in trucks, etc.

On the other hand, the material in the parking lot expected to be dry after the ground water is drawn down with pumping wells and it will not spill as a

liquid, even without fixation. Therefore for material in the parking lot the fixation step is not considered necessary.

Based on the above analysis, the cost-effective remedy for the OMC site is:

Dredge - Dewater in Lagoons-Fix-Dispose for Waukegan Harbor	$35,500,000
North Ditch Area Excavate - Fix - Dispose	$26,820,000
Parking Lot Excavate - Dispose	$12,570,000
Total	$74,890,000

This remedy would have no adverse impacts on the future use of the land because all contaminated material will be removed from the site. All areas would be filled with clean material and graded to preproject elevations.

VII. FUND BALANCING

Under section 300.68(k) of the National Contingency Plan, EPA is required to balance the need for protection of public health, welfare, or the environment against the amount of money available in the Hazardous Substance Response Trust Fund (Fund) in selecting a remedy. EPA must preserve its ability to respond to other sites which present or may present a threat to public health or welfare or the environment, taking into account the need for immediate action. In evaluating the appropriate extent of remedy for OMC, EPA must consider the need to respond to other releases with Fund monies.

Because the estimated cost to implement the cost-effective remedy for the OMC site identified above exceeds $70 million, EPA has conducted an analysis

of Fund assets in which expected Fund receipts are compared with expected future needs for remedial actions at sites currently listed on the National Priority List. In addition, we have considered the expected expenditures for immediate and planned removals and other program needs. These analyses have shown that implementation of the cost-effective remedy at the OMC site will have serious impacts on EPA's ability to respond at other hazardous waste sites.

EPA's Superfund budget prepared for FY 84 allocated $3.4 million for remedial construction at the OMC site. The difference between this allocation and the $75 million necessary to fund the cost-effective remedy is $72 million or more than one half of the $ 130 million FY 84 budget for remedial investigation, feasibility studies and construction. EPA's analysis shows that if all material contaminated to more than 50 ppm is disposed offsite, approximately 100 other projects currently underway or planned for FY 84 would have to be cancelled.

The situation is not expected to improve in FY 85. The FY 85 budget for the entire Superfund program including immediate and planned removals, expected to be approximately $510 million. EPA's analysis show that this FY 85 budget will essentially consume all of the monies left in the Trust Fund. Of that $510 million, an estimated $300 million will be available for remedial actions. The cost-effective remedy for OMC would require 10% of the entire program budget and 22% of the dollars planned for remedial action. The program has identified more than 60 remedial construction projects which will be ready for implementation in FY 85. The total costs of those construction projects will exceed the $300 million expected to be available. Thus, if the cost-effective remedy of OMC is implemented, approximately 8 other construction projects must be cancelled, assuming an average cost of $6 to $8 million for each project.

In light of the high cost of the remedy for the OMC site, both in terms of dollars and other actions which would have to be foregone, the Agency has decided to consider other remedial actions for the OMC site. If the PCB contaminated material at the site can be controlled to the extent that the annual release of PCB from the site approaches zero with some reliability and the relative risk of public exposure to PCB is minimal, then Fund balancing may be appropriate. In evaluating other remedial alternatives, the Agency's objective was to find the least cost alternative which controls the PCB contaminated material on-site such that the release of PCB's from the site will approach zero.

VIII. FUND BALANCED ALTERNATIVE - RECOMMENDED FOR IMPLEMENTATION

In evaluating remedial options for Fund-balancing at the OMC site, on-site was considered. As stated above, there are problems associated with the reliability of onsite containment. It is impossible to build a containment cell at the OMC site that is equivalent to PCB landfills defined in the PCB regulations. In looking at options for Fund balancing, therefore, the Agency tried to developed a balanced combination of options that takes into account the lesser reliability of the onsite containment cell yet minimizes the very expensive offsite transport and disposal. Accordingly, the option recommended for implementation includes both offsite disposal and onsite containment components. In addition, the recommended option includes extensive post closure monitoring of the containment cells to ensure their continued integrity. The multistage process for developing the fund balanced alternative is described below.

A. Development Process

1. First Public Comment Period

In July 1983, EPA proposed five cleanup actions for the three PCB contaminated areas of the OMC site. The actions included both offsite disposal and on-site containment components. Actions 1 and 2 concern Slip No. 3 and the Upper Harbor.

Action 1:

In conjunction with Action 2, below, PCB-ontaminated sediment, sand and silt would be dredged from the localized area near the former OMC outfall in Slip No. 3. An estimated 5,700 yd^3 of PCB contaminated material, containing about 286,500 lb of PCBs would be removed, fixed and disposed offsite in a licensed chemical landfill. The estimated cost is $3,150,000.

Action 2:

A containment wall would be constructed around the perimeter of the western portionof Slip No. 3, part of the Upper Harbor sediments would be dredged into the contained area; the containment area would be capped. Approximately 306,900 lb or PCBs in 21,100 yd^3 of sediments would be contained. The estimated cost is $6,100,000.

Actions 3 and 4 concern the North Ditch Area.

Action 3:

PCB-contaminated soil would be contained and capped in the Crescent Ditch/Oval Lagoon area. The North ditch would be partly excavated to install a bypass drainage pipe. The PCB-contaminated soil from the bypass excavation would be placed in the Cresent Ditch/Oval Lagoon area before capping the area.

Approximately 492,100 lb of PCBs in 51,400 yd^3 of soil would be contained. The estimated cost is $4,210,000.

The total estimated cost or the five actions is $17,410,000.

2. Second Public Comment Period

Upon further review of the proposed remedial alternative and the comments generated during the first public comment period, EPA decided to reexamine the Slip #3/Upper Harbor portion of the five cleanup actions. The initially proposed action provided for containment of all Sediment contaminated to 150 ppm in the Upper Harbor.

The Agency decided consider an alternative which would contain all sediments contaminated to 50 ppm remaining in the Upper Harbor. With the addition of this material, approximately 310,000 lbs of PCBs in 46,600 yd^3 of sediments would be contained in a larger containment cell. The larger cell would esentially eliminate the water frontage portion of Larsen Marina. The estimated cost of Action 2 described above with the increased control to 50 ppm is $9,300,00. This increased the total cost for the five actions to $20,610,000. The change to Action 2 resulted in all of the five cleanup actions providing for containment or off-site removal of all materials contaminated to 50 ppm. At the same time the Agency decided to consider the possibility of building a containment cell in the Slip/Harbor area without constructing a replacement slip.

Previously, all of the alternatives in the Feasibility Study regarding the construction of a containment cell in the Slip/Harbor area included the construction of a replacement slip.

In March 1984, EPA again opened a public comment period regarding the Feasibility Study soliciting comment on all of the alternatives. In addition public comment

was solicited regarding increasing the scope of the Slip/Harbor containment cell to contain PCB contaminated sediments to 50 ppm and not building a replacement slip.

3. Final Selection Process

After the close of the second comment period in April of 1984, EPA re-examined the feasibility study and public comments in order to determine the best approach for a Fund-balanced remedy for the OMC site. This examination focused on the contaminated material in slip #3 and the Upper Harbor.

During this re-examination the Agency again reviewed all costs and all possible technologies available in the matrix of cleanup actions addressed in the feasibility study. It became apparent that EPA would assume a risk of greater than expected costs for contament in slip #3 and that a different combination of alternatives regarding the Slip #3/Upper Harbor area and the Parking Lot might provide substantially equivalent environmental benefit at approximately the same cost.

4. Review of Alternatives

The feasibility study included an alternative to dredge, dewater in lagoons and remove offsite all sediments with concentration of PCB greater than 50 ppm. The cost of the alternative is estimated at $21,300,000 and would result in returning the Slip #3/Upper Harbor area to its original use upon completion of the action. There are two primary concerns regarding this alternative; the cost of the option and the volatilization rate from the sediments during the two year dewatering period. Variations in this alternative to provide essentially equivalent environmental protection at approximately the same cost as the alternative previously recommended are described below.

Similar Cost:

The major difference is cost between containment in slip #3 and the alternative to dredge-dewater in lagoons and dispose offsite resulted from the third component; the offsite disposal of the material. If the material could be disposed onsite, the cost of the two alternatives is similar. If, in addition, EPA considers the potential risks of costs associated with aquiring access to Slip #3 and the Upper Harbor to build a containment cell, the costs of the two are essentially the same.

Two possible locations for the final disposal of the solids could be the Parking Lot area and the North Ditch area of the OMC site. Both of these areas contain PCB contaminated sediments and a number of alternatives had been developed which contemplate the construction of containment cells in these areas. The addition of material to either of the cells will not substantially increase the cost to build the containment cell. As the Parking Lot containment cell proposed during the public comment period is larger than the North Ditch area cell, the Parking Lot area is considered more suitable for containment of the dredged solids from the Slip and Harbor. Instead of containing 100,000 cubic yards of material and being 5 feet above grade, as it was proposed, this cell would contain 140,000 cubic yards and be 14 feet above grade, if the material from the Harbor is added.

The present worth of this option if the material is disposed on site is approximately $10,000,000. Although this is significantly less than the cost of this alternative if the material is disposed offsite, it is still more than the cost of containing the material in Slip 3. EPA previously estimated the cost of containment of all harbor wastes above 50 ppm in Slip 3 at $9.3 mi' including $1.2 million for construction of a slip to replace Slip 3.

construction without these replacement costs would be $8.1 million, or $1.9 million less than the parking lot. However, if EPA did not build such a slip, it might be required to compensate Larser Marine and the other slip owner for the property interest needed to build a containment cell in the slip. For a varietty of reasons, including the fact that the exact size of the coantainment cell cannot be determined prior to final design, EPA has been unable to obtain any accurate assessment of the cost of acquiring the necessary property interest. However, based on a review of all the data in the record the Agency has believes that the costs of acquiring these rights may be substantial and may, therefore, significantly reduce the apparent $1.9 million difference between the parking lot and slip options.

Environmental Factors:

An option to dredge, dewater-in-lagoons and contain on the parking lot presented the same environmental concerns during the dewatering phase as the option presented when the material was to be disposed offsite. The dewatering in lagoons will depend on evaporation to dewater the sediments and will take two years. During this dewatering, a great deal of PCB could volatilize from the sediment. To minimize the risks of PCB volatilization from the dewatering lagoons, the more highly contaminated sediments from Slip 3 (1,000 ppm - 10,000 ppm) would be dewatered and fixed in a much faster process. This will lower the concentration of PCB in the dewatering lagoons to below 1,000 ppm and lower the estimated volatilization from the ponds to less than 1.4 lbs per day. (The hot spots in Slip 3, with concentration of 10,000 ppm - 300,000 ppm, would be disposed offsite as described in Action 1. This discussion relates only to the sediment handled as part of Action 2.) The step of "fixing" the higher concentration of PCB contaminated reduces the risk of environmental harm from volatilization.

In addition to the environmental effects of the dewatering of the sediments, EPA considered the effects of using the parking lot containment cell to contain the Harbor sediments. One effect is an increase in size of the containment cell on the OMC parking lot. The volume of this cell will be expanded by raising the top an additional 10 feet above grade. The impacts of the expansion of the cell were judged to be minor. The sell was already proposed to be 5 feet above grade, the additional 10 feet presented no additional complications.

Another example of the type of effects considered was a longer construction time for the parking lot containment cell which could not be completed until the sediments are dewatered (up to two years). This effect was considered to have a minimal impact, too.

Finally, because the parking lot containment cell for the Harbor materials is above grade, any leakage of materials and the integrity of the cell itself could be more easily monitored. Based on analysis of the environmental impacts, dewatering the Harbor sediments and containing them in a cell on the OMC parking lot presents similar environmental benefits to containment of the sediments in Slip #3.

Selection of Containment Site

Based on the analysis of the cost presented above, the difference in costs is less than $1.9 million, possibly substantially less. However, the parking lot option may result in some environmental benefit due to ease of monitoring. In addition, the parking lot option has advantages in terms of ease of implementation.

A containment cell must be built under the OMC parking lot to contain the contaminated soils in that area. Long term access to that property is necessary for that cell regardless of where the Harbor material is contained. If a containment cell is built in Slip 3, long term access to property owned by Larsen and EJ & J Railroad is also necessary.

Containment of the Harbor material in the containment cell on the parking is easier for EPA to implement because it will require long term access to only one parcel of property instead of three parcels. On this basis, EPA has concluded that the potential cost difference is outweighed by potential monitoring advantages and reduction of implementation advantages of containing these wastes in the parking lot area.

B. Waukegan Harbor

1. Hot Spots

In some portions of the site, the concentrations of PCB are so high that off-site disposal is considered to be the minimally acceptable protection of the public health. This is the case for those highly contaminated sediment identified in Slip No. 3. The extremely high concentrations of PCB's in a relatively small volume of material mandates that this material be handled with great care and placed in a highly reliable a chemical landfill, which is designed to protect public health to the greatest extent possible.

As identified in the feasibility study and previous work prepared by Mason and Hangar Company, the presence of extreme high concentrations of PCB's exerts

an unacceptable diffusionary pressure on underlying sediment or toward any slurry wall which would be built to contain such material. Removal of the most highly contaminated material for offsite disposal is necessary to control the driving force that is causing the PCB's to spread into the underlying clay. This is demonstrated by the core data from the slip which shows that in areas of highest contamination, PBC's have moved downward into the clay and in areas of lesser contamination the PCB's have not penetrated the underlying clay. Thus, if the material is not removed, the containment cell would be much more prone to leakage.

In addition, the feasibility study demonstrates that after two years the containment cells will begin to leak a small quantity of water, based on a permeability coefficient of 10^{-7} centimeters/minute. If the highly contaminated material is not removed, the leachate will considerably more contaminated and thus present a larger threat to public health and the environment.
There is no alternative less costly than the cost-effective remedy that approaches the effectiveness of off-site disposal. The costs of off-site disposal of these sediments is $3,150,000.

2. Less Contaminated Portions of Slip 3 and Upper Harbor

The less contaminated sediments in Slip No. 3 and Upper Waukegan Harbor may be contained onsite. Because the sediments in this area are contaminated with PCB's in lower concentrations, the glacial till which is beneath the OMC site will act as an effective seal. No PCB's have been found in the till under moderately contaminated sediments and soils. Therefore, adequate containment

onsite is possible for these moderately contaminated materials.

This containment will effectively control the major mechanisms for the release of PCB from the OMC site. The volatilization of PCB will be prevented because the containment cells will be capped with several feet of impervious material. The transport of contaminated sediment will be eliminated because the sediment will contain behind impermeable slurry walls. Finally, the contamination of surface water with PCB will be eliminated because the water will no longer be in contact with PCB contaminated sediment.

EPA evaluated two ways to contain this material onsite; dredging the Upper Harbor to contain the contaminated material in Slip 3 and dredging both the Upper Harbor and Slip 3, dewatering the material and containing it on OMC property. Based on the analyses presented in the discussion in Section A, the latter option is recommended.

Upon completion of this project the harbor, Slip 3, and the vacant property can be returned to its existing use.

C. Oval Lagoon and Crescent Ditch

Some of the sediments in the Crescent Ditch/Oval Lagoon area of the site are as highly contaminated as those in Slip #3. Fund balancing is not appropriate for these sediments for the same reasons as it was inappropriate for the Slip #3 sediments; containment does not provide adequate protection of public health and the environment because the glacial till has been shown to be unable to adequately prevent migration of that material.

Off-site removal and disposal in an landfill as defined in the PCB regulations is necessary to ensure the reliability of the containment cell bottoms and sidewalls and to prevent the leachate from the cell from becoming more concentrated due to the highly contaminated material within the cell.

Contaminated material remaining after hotspot removal will be contained in place through the use of slurry walls and a clay cap. In addition, the material generated as a result of sewer installation will be contained on site.

This containment structure is necessary to bring annual rates of release rate to zero from this portion of the site. Surface water and ground water flows will be removed from contact with the contaminated material. The containment cell will be more reliable because the most highly contaminated material will be removed for offsite disposal. The mechanisms of release of the PCB's will be essentially halted by implementation of this alternative.

a. Some increased volatilization will take place while the construction is underway, but once the clay cap is in place, volatilization will be reduced to zero.

b. Ground water flows will be diverted around the containment site by the slurry walls.

c. The underlying till will prevent the release of PCB contaminated sediment because of its thickness and impermeability.

d. Surface water will be diverted around the cell by the impermeable clay cap. Contaminated material will no longer be in contact with surface water and surface water dispersion of PBC's will be halted.

e. Sediment transport will be stopped because the material will be contained in a cell.

D. North Ditch

Under this alternative, the North Ditch will be partially excavated in order

to install a bypass sewer pipeline. As stated above contaminated soil from the excavation would be placed in the Oval Lagoon area and capped with clay. A series of manholes would be built into the sewer and surface drainage routed to the manhole drains. This will separate surface flows from contaminated material. Under the recommended Fund Balanced alternative, soils contaminated with PCB's will be left in place under the storm sewer. Protection of public health is provide because these soils are isolated from release to the environment. Recontouring of the surface profile, a result of implementing the above-mentioned alternatives, will alter ground water exposure to the soils and reduce flows through the area. The contaminated soils are isolated on the north side by existing sheet pile and ground water flows on the other sides will be reduced by the sewer, capping and installation of the parking lot slurry wall, and installation of sheet pile on the south side of the ditch.

The main method of release of PCB's from this sub area is via the flowing water in the North Ditch. Volatilization is also associated with the flowing water. Implementation of the fund balanced alternative will eliminate the mechanism of release in the following ways:

a. Surface water flows - This is the main mechanism of release of PCB's from the site to Lake Michigan. Surface water flows will not transport PCB contaminated sediment toward Lake Michigan because they will be isolated within the pipe. Likewise, dissolved PCB's in the water will be reduced to approximately zero because the water will not be exposed to contaminated sediment.

b. Ground water flows - Some contaminated sediment which remains in the ditch, after stallation of the sewer will still be exposed to ground water flows. There will be a potential that a small quantity of PCB's would leave the site through this mechanism of release, however, the ground water flows will be reduced because the ditch will be graded and capped after sewer installation. Surface flows, being directed to sewer inlets, will reduce the amount of water available to transport PCB's offsite. Under the fund-balanced alternative, the extent of remedy is viewed

as sufficient to protect public health, but less effective than the cost effective remedy which would require complete sediment removal and backfilling prior to sewer construction.

c. Volatilization - This will be significantly reduced because the entire area will be capped.

E. Parking Lot

The recommended fund-balanced approach for dealing with the large volume of contaminated soil in the parking lot involves in place incapsulation. Approximately 277,700 pounds of PCB's in 105,000 yd3 of soil would be contained and capped in the parking lot area. Slurry walls would be constructed around the perimeter of the major contamination and tied into the underlying glacial till. The underlying till would be relied upon to contain the downward movement. A clay cap would seal the top preventing surface water percolation into the cell. Riprap would protect the east edge of the cell from wave or other errosion actions. Encapsulation was chosen as the fundbalanced alternative over excavation and removal, the costeffective alternative, because it provide a high degree of protection of public health and the environment for substantially less money. The PCB's in the parking lot have been shown to be moving slowly toward Lake Michigan. The fund-balanced alternative will further slow or contain that release of PCB's to the lake environment. The fund-balanced alternative controls the mechanisms which were causing the PCB's to leave the site.

1. Ground Water - Ground water movements are the main driving force here, causing the PCB enclaves in soil to move slowly toward Lake Michigan. Surrounding the contamination mass with slurry walls will divert the ground water flows away.

2. Surface Water - Surface water currently percolates through the surface and sand exerting pressures on the PCB masses to move down gradient. The surface water route will be eliminated because of the cap.

3. Volatilization - Currently, volatilization is rather small because of soil cover and the site is partially paved. However, the cap will aid in further reducing ulitization.

Technical components and costs of the remedial alternative recommended for implementation of, given Fund Balancing considerations are summarized in Table 2.

F. Evaluation of Threat Under Fund Balanced Alternative:

In sections I and III of this documentation it was shown that the uncontrolled PCB's at the OMC site were being released from that site in significant quantities and were posing a threat to public health and the environment as a result of that release. The alternative described above will sucessfully control the PCB's at the site and bring the release of PCBs to almost zero. In doing so the threat to public health and environment posed by the site will be mitigated so long as the containment cells function as they are designed. Because the cells would not comply with TSCA requirements of PCB landfills and the Agency has concerns about the long term reliability of the cells, off site transport and disposal is considered the minimum adequate alternative and the cost-effective alternative.

The fund balanced alternative which includes both off site disposal and on site contamination is only slightly less than fully adequate, however. The very highly contaminated material is removed from the site and the threat posed by the moderately contaminated material is mitigated because material is contained with a relatively high degree of reliability.

The threat posed to public health and the environment by the site after this option is implemented will be small. Because this alternative provides

almost as much protection for significantly less cost than the cost effective option, Fund balancing is considered appropriate at this site.

IX. TSCA

As the recommended fund-balanced alternative includes the construction of two on-site containment structures for the disposal of PCB dredge material and soils, the Region evaluated this action in light of the Toxic Substances Control Act (TSCA) regulations (40 CFR Part 761).

Pursuant to 40 CFR Part 761.60(5), all dredged materials that contain PCBs must be disposed of in one of three ways: 1. in an incinerator which complies with 40 CFR Part 761.65; or 2. in a chemical waste landfill which complies with 40 CFR Part 761.65; or 3. upon application, using a disposal method to be approved by the Regional Administrator in the Region where the PCBs are located.

The Regional Superfund Office applied to the Regional Administrator for the approval of an alternate disposal method. The Regional Administrator denied the application. The decision was based upon the failure of the proposed landfill to meet a number of technical requirements traditionally required for approval of an alternate disposal method. The denial cited the following issues as its basis: the lack of a synthetic membrane liner for the containment cells; the fact that the landfill was not 50 feet from the historic high water table; the lack of an internal leachate collection system; and the lack of a 6 foot woven mesh fence surrounding the landfill.